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NOISE HAZARD E'ALUATION SOUND LEVEL DATA ON NOISE SOURCES

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Army Environmental Hygiene Agency

Prepared for:

Army Health Services Command

January 1975

NOISE HAZARD EVALUATION

SOUND LEVEL DATA OF NOISE SOURCES

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US ARMY

ENVIRONMENTAL HYGIENE AGENCY

ABERDEEN PROVING GROUND, MD 21010

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This technical guide was developed as an aid and simplification of the noise hazard assessment element of the installation hearing conservation program. Part I of the technical guide provides the reader with basic information necessary for the conduct of a routine occupational noise hazard evaluation, while part II provides additional information and guidance concerning typical personnel exposures to military noise sources.

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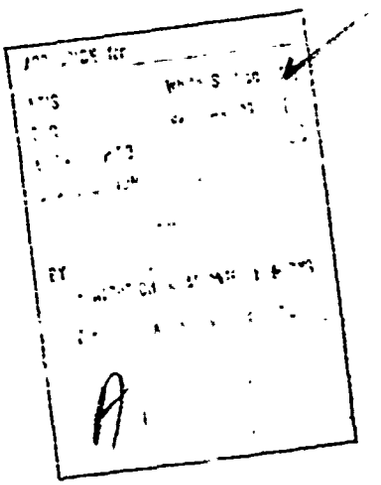
Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

PREFACE

This technical guide was developed as an aid and simplification of the noise hazard assessment element of the installation hearing conservation program. Part I of the technical guide provides the reader with basic information necessary for the conduct of a routine occupational noise hazard evaluation, while Part II provides additional information and guidance concerning typical personnel exposures to military noise sources. Other technical guides available from USAEHA in this hearing conservation series are: (1) Hearing Protective Devices; Fitting, Care, and Use, and (2) Regulations, Specifications, Standards and Sample Installation Supplement to AR 40-5 for Conservation of Hearing. Guidance for the establishment of occupational hearing conservation programs is furnished by TB Med 251 and applicable portions of AR 40-5.



Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

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NOISE HAZARD EVALUATION - SOUND LEVEL DATA OF NOISE SOURCES

PART I - NOISE HAZARD EVALUATION

I. INTRODUCTION. A hearing conservation program consists of five fundamentals:

A. Noise Hazard Evaluation.

B. Engineering Noise Control.

C. Health Education.

D. Audiometry.

E. Hearing Protection.

This technical guide concerns the first of these five fundamentals, i.e., the determination of whether the noise associated with various operations constitutes a potential hearing hazard.

II. THE SOUND LEVEL METER.

A. There is a simple test to determine if a potential hearing hazard is associated with a specific operation - try to carry on a conversation in the area. If it is difficult to converse without shouting, further investigation is necessary. This further investigation should be performed with a sound level meter.

B. The sound level meter changes noise into an electrical signal. The amplitude of this signal is then displayed on a meter. Thus, the sound level meter reads the noise levels directly in terms of the decibel (dB).

C. All sound level meters have at least three components: (see Figure 1)

1. Transducer (microphone) to capture the sound waves.

2. Amplifier to give high gain and low noise, permitting the use of weighting networks and filters.

3. A meter to indicate the value of the amplified signal. The meter is read in decibels which reflects the ear's amplitude sensitivity to sound pressure level changes.

D. There are three types of sound level meters:

1. Type I - Precision Laboratory.

2. Type II - General Purpose.

3. Type III - Survey.

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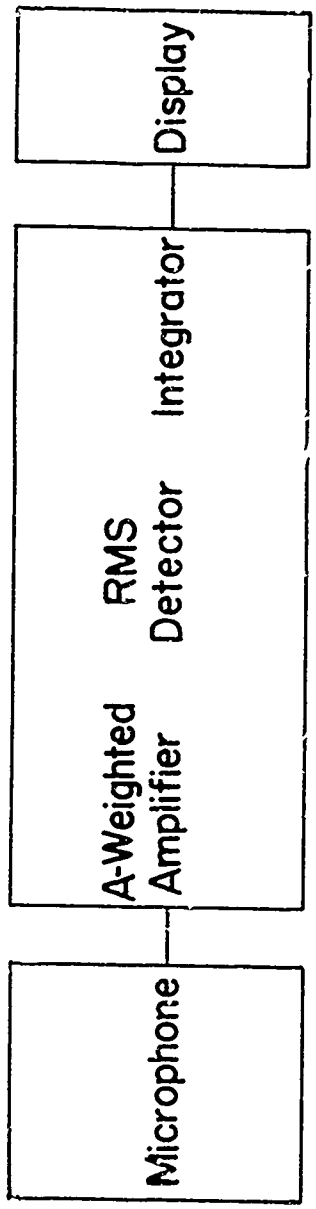
* This Technical Guide supersedes USAEHA-OR, Technical Guide (Med), Sound Level Data of Military Noise Sources, January 1972

FIGURE 1.

BLOCK DIAGRAM OF SOUND LEVEL METER

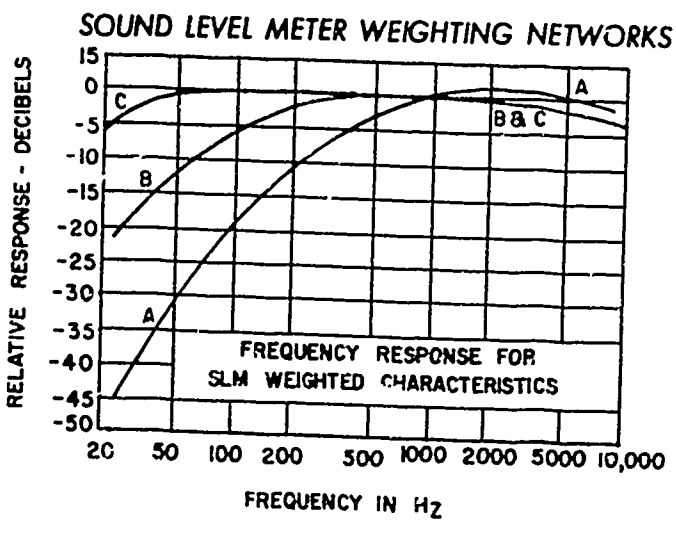


The Types I and II sound level meters are acceptable for use within the Department of the Army (DA). The Type I meter is more accurate than a Type II sound level meter; however, it is much more expensive and more difficult to use. For most applications, the Type II meter is recommended because of these economic and usability considerations.

E. Sound level meters are produced to the same performance specifications worldwide. Therefore, the readings for identical sounds are consistent from one instrument to another.

F. Most sound level meters have three frequency response characteristics or weighting networks: A-weighting [dB(A)], B-weighting [dB(B)], and C-weighting [dB(C)]. (See Figure 2)

FIGURE 2



The ear is not as sensitive to low frequency sounds as it is to high frequency sounds. The A-weighting network of the sound level meter filters out the very low frequencies. Thus, the A-weighting network response approximates the response of the human ear. Sounds measured with this sound level meter weighting network are referred to as dB(A).

G. The sound level meter has the following features: (see Figure 3)

1. On-off switch.

2. Battery check switch.

3. Network selector.

4. Fast-slow meter response switch.

5. Attenuator with 10 dB steps.

6. Indicating meter.

III. HEARING CONSERVATION CRITERIA.

A. Time-Weighted for Steady Noise. (Steady noise is a noise of nontransient nature. It has negligibly small fluctuations of level within a short period of observation. Examples of steady noise are rain, motors, air-conditioners, etc.)

1. For hearing conservation purposes, the maximum exposure recommended by the Occupational Safety and Health Act (OSHA) to single-level steady noise in dB(A) varies with the duration of the exposure as shown in the following table.

TABLE

MAXIMUM RECOMMENDED SOUND LEVEL
EXPOSURE TO STEADY NOISE
MEASURED IN dB(A)

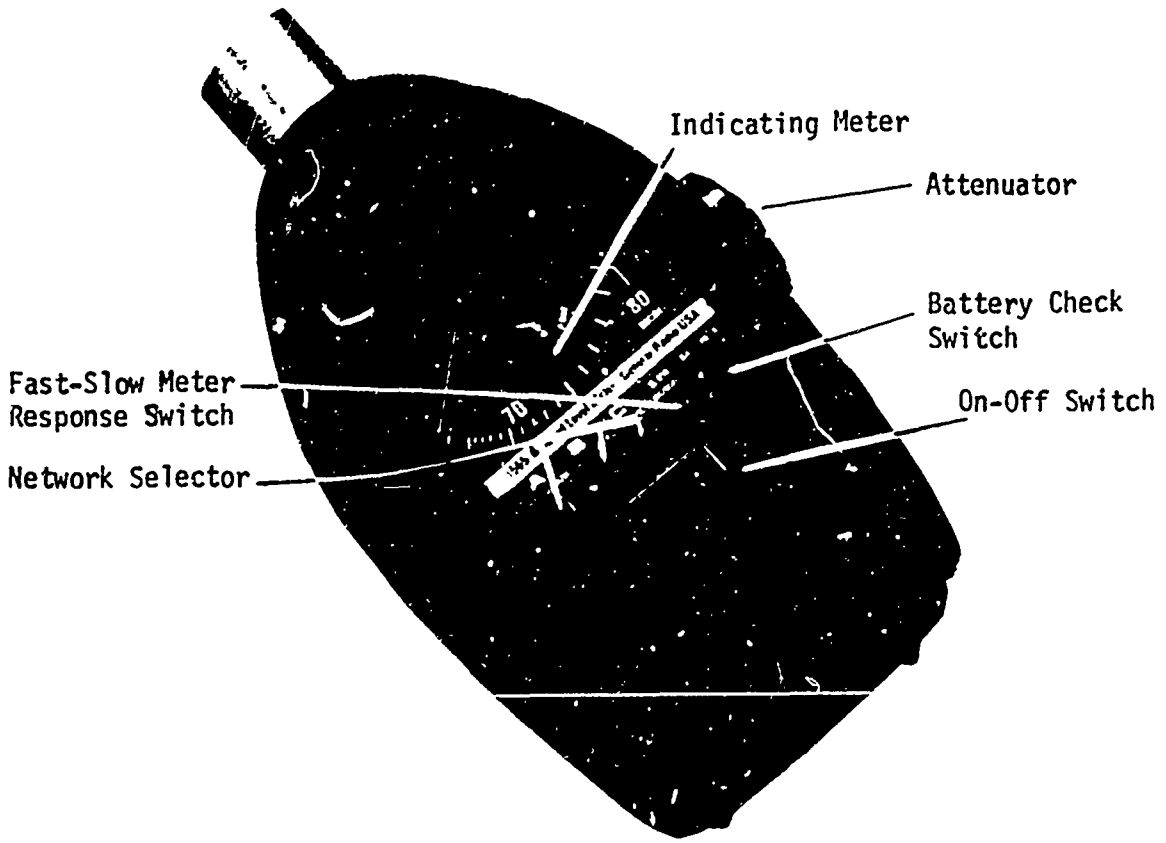
Exposure Duration Per Day In Hours	OSHA	US Army TB MED 251*
16		80 dB(A)†
8	90 dB(A)	85 dB(A)
6	92 dB(A)	87 dB(A)
4	95 dB(A)	90 dB(A)
3	97 dB(A)	92 dB(A)
2	100 dB(A)	95 dB(A)
1 1/2	102 dB(A)	97 dB(A)
1	105 dB(A)	100 dB(A)
1/2	110 dB(A)	105 dB(A)
1/4 or less	115 dB(A) (ceiling)	110 dB(A) (ceiling)

*TB MED 251, Noise and Conservation of Hearing, 7 March 1972.

†To be added in the proposed revision of TB MED 251.

FIGURE 3

SOUND LEVEL METER



2. A time-weighted criterion, 5 decibels more stringent than that recommended by OSHA for use at DA installation or activities, is also presented in the table. This criterion should be used only to:

a. Determine a requirement to initiate engineering control measures in order to eliminate the noise hazard.

b. Determine the noise hazard in identified noise-hazardous areas, equipment, and operations that are not practically suitable to the threshold criterion presented in paragraph III B.

3. When the daily exposure is composed of two or more periods of different noise levels, the levels and exposure durations are combined as follows to determine whether the maximum recommended exposure is exceeded:

$$\text{If the sum of } \frac{A_1}{T_1} + \frac{A_2}{T_2} + \ldots \frac{A_n}{T_n} \text{ (exceeds unity)}$$

"A" indicates actual exposure duration at the different noise levels, and "T" the exposure time permitted at each level as determined from the criterion utilized. For example, utilizing the recommended TB MED 251 time-weighted criterion, a given worker's exposure during an 8-hour day is:

85 dB(A) - 0.5 hr.
87 dB(A) - 1.0 hr.
92 dB(A) - 0.5 hr.

The combined exposure is:

$$\frac{0.5}{8} + \frac{1.0}{6} + \frac{0.5}{3} = 0.4 \text{ (less than unity)}$$

The exposure is therefore within maximum recommended limits.

B. Threshold Criterion for Steady Noise. (Threshold, in this context, is the value which, when exceeded, constitutes a potentially hazardous exposure.)

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1. Within DA facilities, areas or operations will be designated as noise hazardous when an individual is exposed to steady noise levels above 85 dB(A), regardless of length of exposure. OSHA criteria will not be followed. The Army time-weighted criterion may be applied for only those situations discussed in paragraph III.A.1 (reference TB MED 251).

2. From the standpoint of realistically administering a hearing conservation program, the threshold criterion should always be used. Although the time-weighted criterion is technically accurate, there are many practical disadvantages to using this method in the field.

C. Threshold Criterion for Impact or Impulse Noise. (Impact or impulse noise is noise of a transient nature, such as that due to impact or explosive bursts, e.g., gunfire, hammering.)

1. The maximum permissible level of any impact noise at the ear is 140 dB peak sound pressure level (reference TB MED 251).

2. Impact or impulse noise can only be measured on a sound level meter with an impulse meter response characteristic, or on special instrumentation, such as an impact noise analyzer.

D. Typical Noise Levels:

Rustling leaves	20 dB(A)
Whisper	34 dB(A)
Window air-conditioner	55 dB(A)
Conversation	60 dB(A)
Vacuum cleaner (at 10 ft)	65 dB(A)
Alarm clock (at 2 ft)	80 dB(A)
Printing plant	86 dB(A)
Diesel truck (at 25 ft)	92 dB(A)
Air compressor	94 dB(A)
Cut-off saw	97 dB(A)
Lawn mower	98 dB(A)
Bench grinder	105 dB(A)
Air chisel	106 dB(A)
Vacuum pump	108 dB(A)
Chain saw	115 dB(A)
M14 rifle	160 dB peak sound pressure level
Howitzer	185 dB peak sound pressure level

IV. THE NOISE SURVEY

A. General.

1. A complete inventory and measurement of noise-hazardous equipment should be conducted at least annually. In addition, noise measurements should

be taken within 30 days of the procurement of new, potentially noise-hazardous equipment; the modification of noise-hazardous equipment; and any change in equipment operational procedures.

2. Even though noise is a complex phenomenon, noise measurements are relatively simple to make. The noise survey includes many noise measurements and observations which permit the evaluation of noise exposure.

3. Before using the sound level meter, investigate the area in which the noise survey is to be made to determine what measurements would be representative of employee noise exposure. The problem is to determine whether or not each worker or group of workers is being exposed to noise which may damage their hearing. First, determine the location or locations where noise measurements will be made. It is essential that measurements are made at all locations where the worker spends his work day. Go into the work area and ask questions - get a "feel" for the problem. Get all the essential information you need before even attempting to measure with the sound level meter.

B. Operational Pre-Check.

1. A sound level meter, like any precision instrument, should be checked regularly. At a minimum, the sound level meter must be checked before it is taken into the field.

2. An acoustic calibrator is an essential part of the noise measuring system. By fitting it over the microphone, the sensitivity of the sound level meter, including the microphone, can be checked. A step-by-step pre-check involves:

a. Turn power on.

b. Check for visual damage of meter.

c. Check batteries.

d. Allow the instrument to warm up for a few minutes.

e. Calibrate with an acoustic calibrator in a quiet location.

(Consult the instruction manual supplied with the instrument for the proper calibration and battery check procedures for your particular sound level meter.)

3. Once the sound level meter is turned on, leave it on if you know you will be using it within a short period of time. Do not keep turning the meter on and off.

4. If the sound level meter appears to be out of calibration, consult the instruction manual supplied with the instrument for necessary adjustment or repairs.

5. If the battery check indicates weak batteries, the batteries should be replaced before making measurements.

C. The Survey.

1. Take extreme care in transporting the sound level meter. Do not bang it around. Do not expose it to temperatures above 115°F. Do not leave it in the trunk or inside a closed automobile on a hot, summer day. Do not expose it to any moisture.

2. In most areas you will be concerned primarily with noise near the normal position of the worker's ear. You may wish to measure the noise at other points in the work space as well, depending upon the area.

3. Try to get measurements during typical normal operations. In noting your results, always specify the machinery operating, and the characteristics of the operation.

4. The essential information required for noise hazard evaluation has to be in terms of dB(A). Therefore, be sure your sound level meter is set to the A-weighting network when making noise measurements. The results should always be written as "dB(A)". For example, "87 dB(A)" is correct; "87 dB", "87 noise level", and "87 sound level" are all incorrect.

5. Use the slow setting on the sound level meter. This averages the rapid fluctuations of sound levels and makes meter reading easier.

6. Operation of the sound level meter is a simple five-step procedure:

a. Set the weighting switch to "dB(A)".

b. Set the meter response to "slow".

c. Adjust the meter range switch.

d. Read the meter.

e. Add the meter reading to the range setting.

7. Consult the instruction manual supplied with the instrument for information on how to point the sound level meter.

8. Hold the sound level meter away from your body when taking noise measurements.

9. Be alert to detect errors due to the operation of the equipment, calibration of the system, or the influence of the environment.

10. Upon completion of the survey, re-check the calibration of the sound level meter.

D. Hearing Conservation Program Noise Survey Data Card. The sample Hearing Conservation Program Noise Survey Data Card shows all the information needed for a noise survey (see Figure 4).

1. Record date, time of day, and exact building or area location. This identifies the measurement conditions.

2. Record the sound level values measured [dB(A), peak sound pressure level (SPL), etc.].

3. Record the performance conditions or the operation characteristics of the machinery during noise measurement (rpm, load, etc.). Also record the location of the sound level meter microphone (operator's ear, etc.). Draw a diagram if necessary.

4. Record the number of people exposed to the noise source and the duration of exposure.

5. Document whether the area had previously been designated noise-hazardous, whether appropriate caution signs are posted, if hearing protective devices are being used, and if audiometric evaluations are given to personnel working in the area.

6. Record the recommendations for action on the Noise Survey Data Card to insure that they are never separated from the noise measurement records for the location.

7. Keep a record of the type, model, manufacturer, and serial number of the sound level meter and calibrator used for the survey, as well as the name of the individual performing the survey.

8. Keep these forms in your hearing conservation program files. OSHA requires that these records be kept for a minimum of 5 years.

V. OTHER INSTRUMENTATION.

A. When noise levels to which an individual is exposed fluctuate significantly and often during the work day, the manual computation technique

FIGURE 4
HEARING CONSERVATION PROGRAM
NOISE SURVEY DATA CARD

Building No.: Directorate: Date:
Shop: Division: Time:

DIAGRAM & DESCRIPTION

Notes

NOISE EXPOSURE

Steady Noise		Steady Noise	
Continuous	____	63	____
Intermittent	____	125	____
		250	____
Impact Noise		500	____
Continuous	____	1000	____
Intermittent	____	2000	____
		4000	____
		8000	____
		A Scale	____
		C Scale	____
		Impulse Noise	
		Peak	____

Steady Noise		Steady Noise	
Continuous	____	63	____
Intermittent	____	125	____
		250	____
Impact Noise		500	____
Continuous	____	1000	____
Intermittent	____	2000	____
		4000	____
		8000	____
		A Scale	____
		C Scale	____
		Impulse Noise	
		Peak	____

REMARKS

Microphone Position:

Area Previously Designated: Yes.____ No.____

No. of employees exposed: ____
Duration of exposure: ____
Hearing protection:
Used ____ Not Used ____ Type ____

Signs Posted.____ Signs not posted.____
Audiometric evaluation? Yes.____ No. ____

USAEHA Form 3404, 1Sep72. Replace USAEHA Form NP-1, 15Sep65 which may be used.

(time-weighting) becomes difficult and time consuming to perform reliably and accurately. The use of a noise dosimeter which automatically measures and computes the total exposure is more economical. Audio-dosimeters are instruments which measure the noise amplitude to which the ear is exposed, and integrates it against the time of exposure on a continuous basis during the 8-hour work day. Because DA facilities adhere to a threshold criterion of 85 dB(A), audio-dosimeters should not be used.

B. The octave band analyzer is an instrument which is used to separate a complex noise into frequency bands one octave in width, and measures the sound pressure level in each of the bands. This is useful in studying a noise source to determine a suitable engineering noise control procedure. Octave band analysis is not needed for the routine hearing conservation noise survey.

VI. NOMENCLATURE AND NATIONAL STOCK NUMBERS (NSN) OF NOISE MEASUREMENT EQUIPMENT.

A. Sound Level Meters (NSN 6625-00-003-9714, Sound Level Meter, General Purpose, ANSI Standard S1.4-1971). A battery-powered portable instrument to measure noise levels up to 140 decibels. Meets the specifications for a Type II instrument set forth in American National Standards Institute (ANSI) 1969 Standard S1.4-1971, "Specifications for Sound Level Meters".

B. Sound Level Calibrator (NSN 6625-00-438-0626). A battery-powered portable unit for making accurate field calibrations on microphones and noise measuring instruments. A sound level calibrator must be available for the calibration of noise measuring instrumentation, prior to, during, and after each noise measuring session .

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PART II - SOUND LEVEL DATA OF NOISE SOURCES

I. INTRODUCTION.

A. Guidance for the establishment of occupational hearing conservation programs is furnished by TB MED 251 and applicable portions of AR 40-5.*

B. The purpose of Part II of this Guide is to provide additional information concerning exposure to noise sources and the use of personal hearing protective devices. This includes:

1. Representative 140 dB peak sound pressure level contours of small arms and artillery weapons.

2. Peak sound pressure level measurements of weapons at the firer or crewman positions.

3. Maximum A-weighted sound pressure levels of fixed- and rotary-wing aircraft, combat and noncombat vehicles, powered metalworking and woodworking machinery, data processing equipment, pneumatic machinery, construction equipment, and other machinery.

4. Data relative to the type, nomenclature, and use of hearing protective devices.

5. Acoustic measurement procedures and references used in the preparation of the sound level data.

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*AR 40-5, Preventive Medicine, 25 September 1974.

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II. WEAPON CONTOURS.

A. Individual- and Crew-Served Small Arms.

Figure 5	Test Site Plan
Figure 6	.45 Caliber Pistol, Automatic, M1911
Figure 7	50 Caliber Machine Gun, M3
Figure 8	7.62 mm Machine Gun, M60
Figure 9	81 mm Mortar, M1
Figure 10	90 mm Rifle, M67
Figure 11	66 mm Light Anti-Tank Weapon, M72

B. Artillery Weapons.

Figure 12	Test Site Plan
Figure 13	120 mm Gun, Tank Mounted
Figure 14	152 mm Gun, Pedestal Mounted
Figure 15	105 mm Howitzer, Light, Towed, M114
Figure 16	155 mm Self-Propelled Howitzer, M109
Figure 17	155 mm Howitzer, Medium, Towed, M114A1
Figure 18	8-In. Howitzer, Heavy, Self-Propelled, M110
Figure 19	175 mm Gun, Self-Propelled, M107

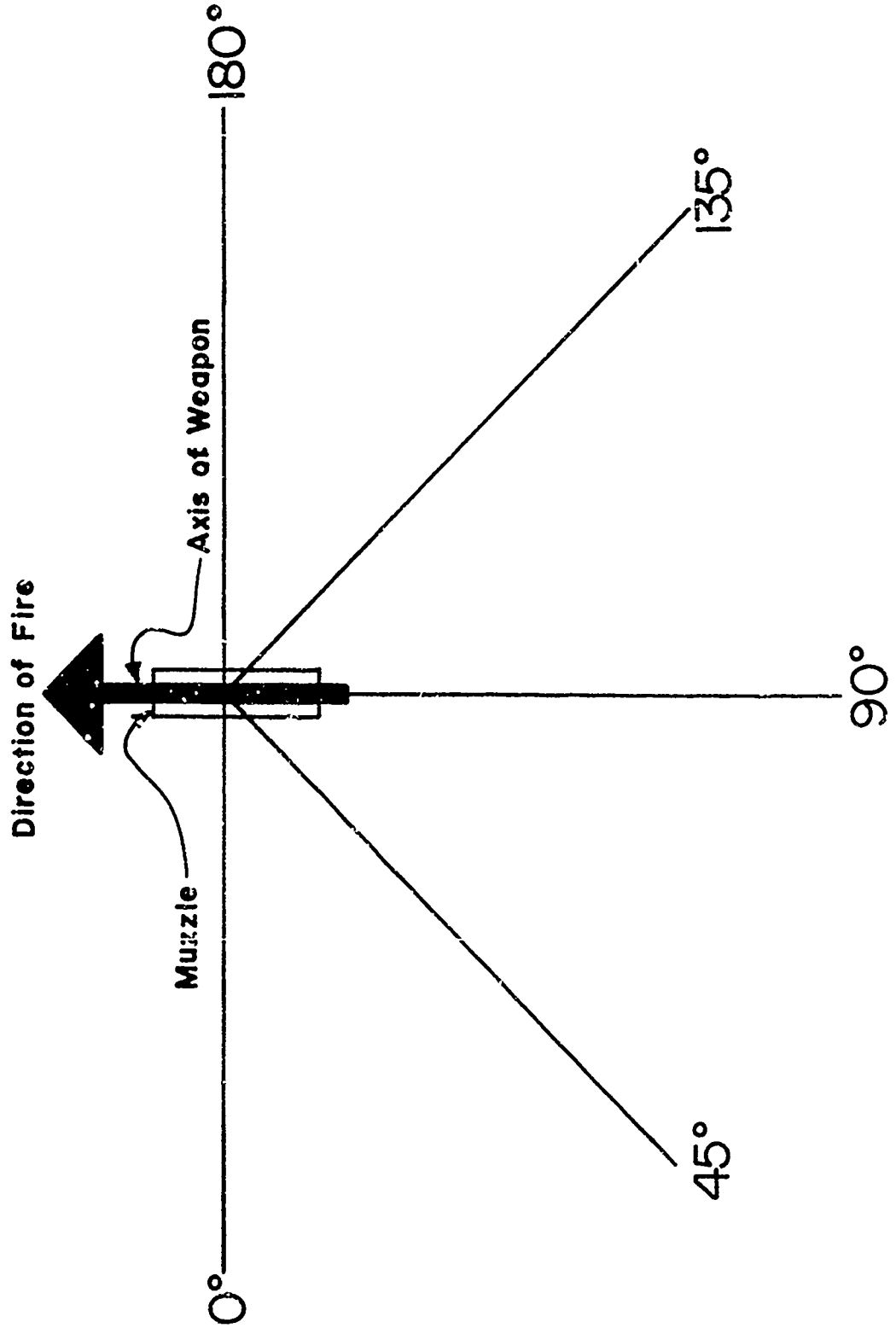

FIGURE 5 TEST SITE PLAN

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Individual NOMENCLATURE CAL .45 Pistol, Automatic, M1911 FSN

MFG MODEL SERIAL NO. REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71

REPORT NO. ORGANIZATION INVESTIGATOR(S) DATE Nov 1970

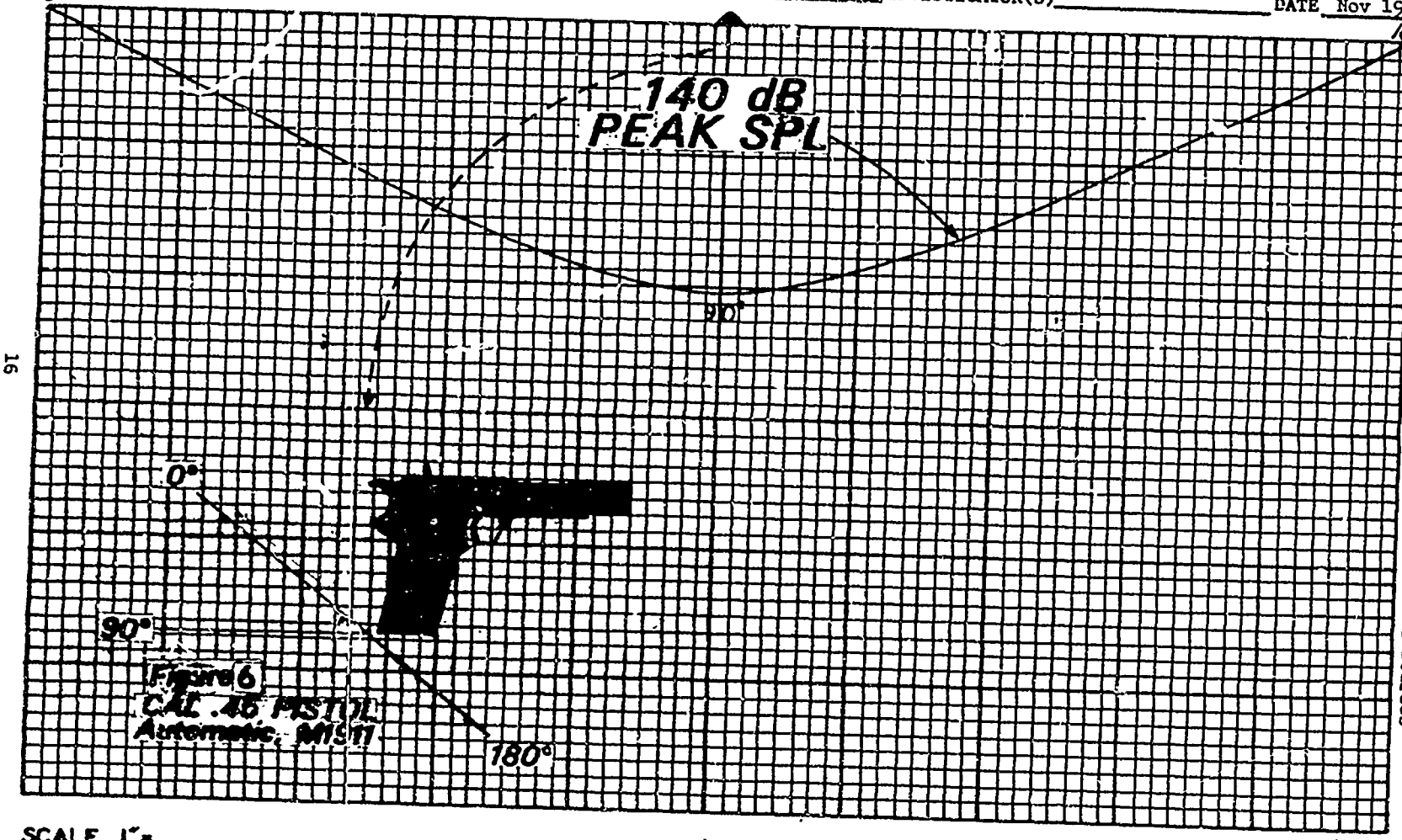

Figure 6
CAL .45 PISTOL
Automatic, M1911

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16

SCALE 1" = _____

0 15 30
Scale in Feet

0 180
45 90 135
DIRECTION

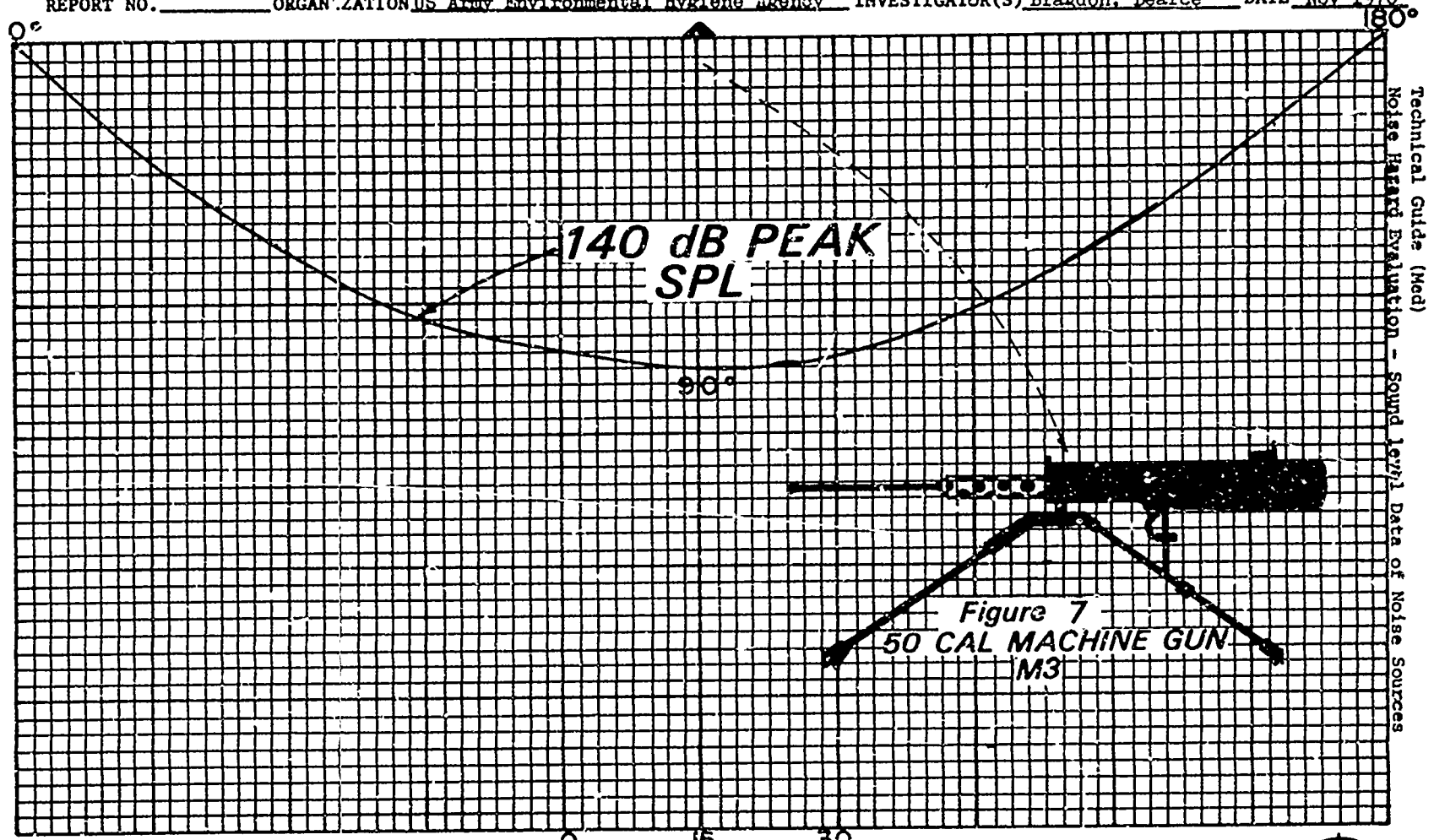
USAEHA Form NP-2-2, 3 Feb 70

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 50 CAL Machine Gun, M3 FSN _____

MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71

REPORT NO. _____ ORGAN'.ZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Bearce DATE Nov 1970



SCALE 1" = _____

USAEHA Form NP-2-2, 3 Feb 70

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Individual NOMENCLATURE 7.62 MM Machine Gun, M60 FSN _____

MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71

REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Bearce DATE Nov 1970

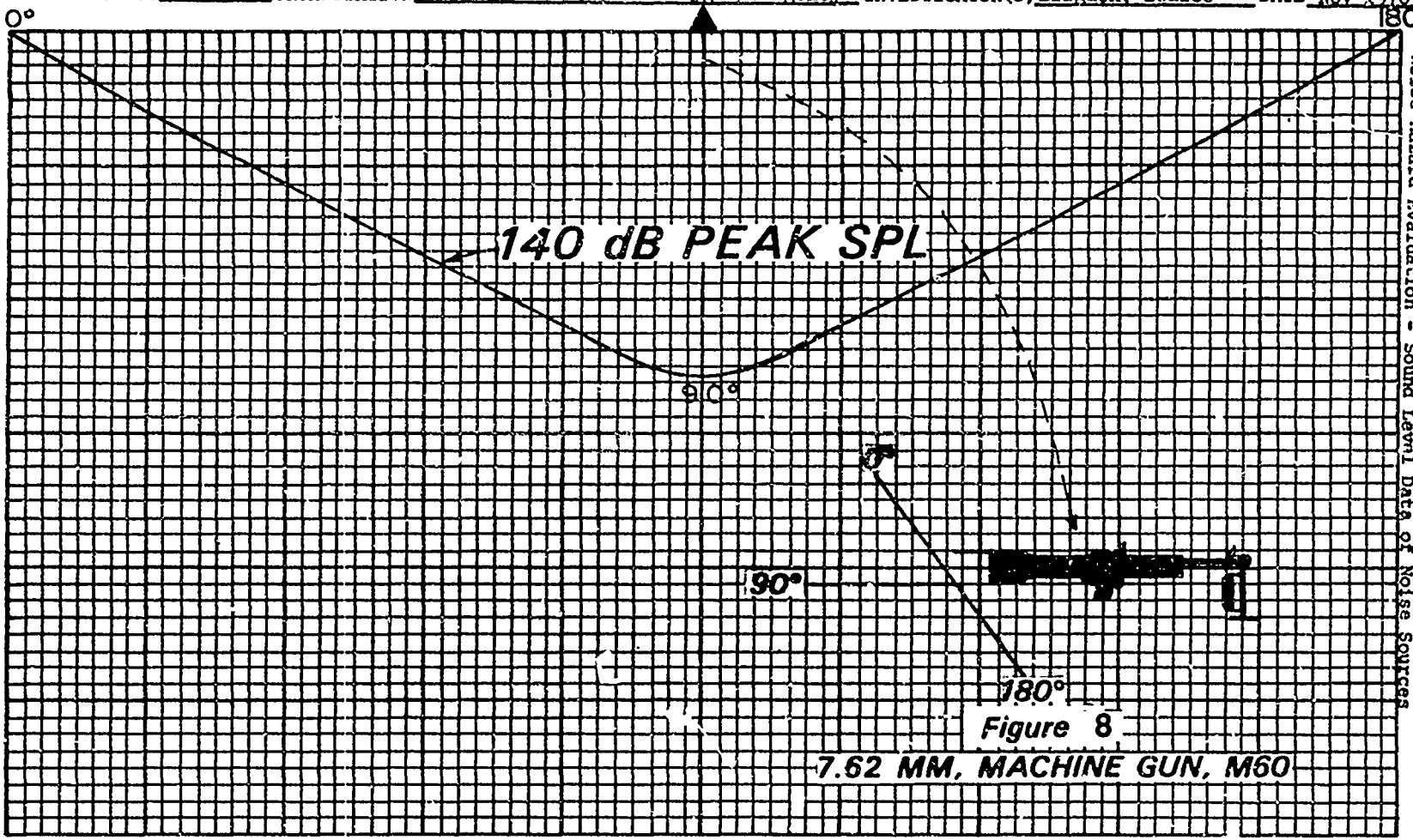


Figure 8

7.62 MM, MACHINE GUN, M60

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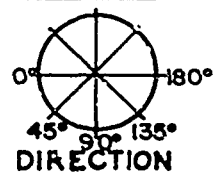
SCALE 1" = _____

0 10 20

SCALE IN FEET



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NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 81 mm Mortar, M1 FSN _____

MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71

REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Bearce DATE Nov 1970

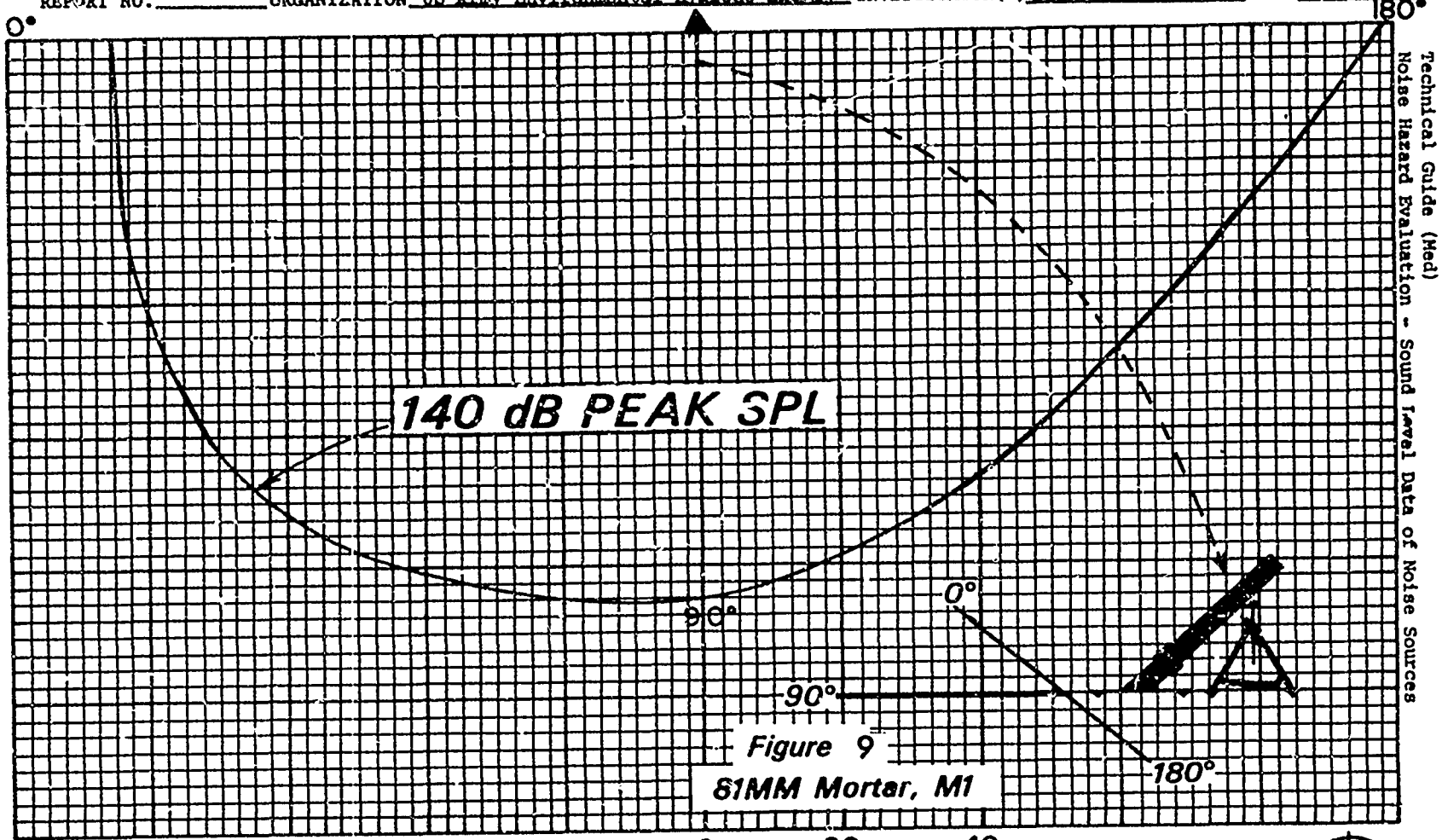

Figure 9
81MM Mortar, M1

SCALE 1" = _____

0 20 40

SCALE IN FEET

0° 180° 45° 135° 90°

DIRECTION

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MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 90 MM Rifle, M67 FSN

MFG MODEL SERIAL NO. REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71

REPORT NO. ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Bearce DATE Nov 1970

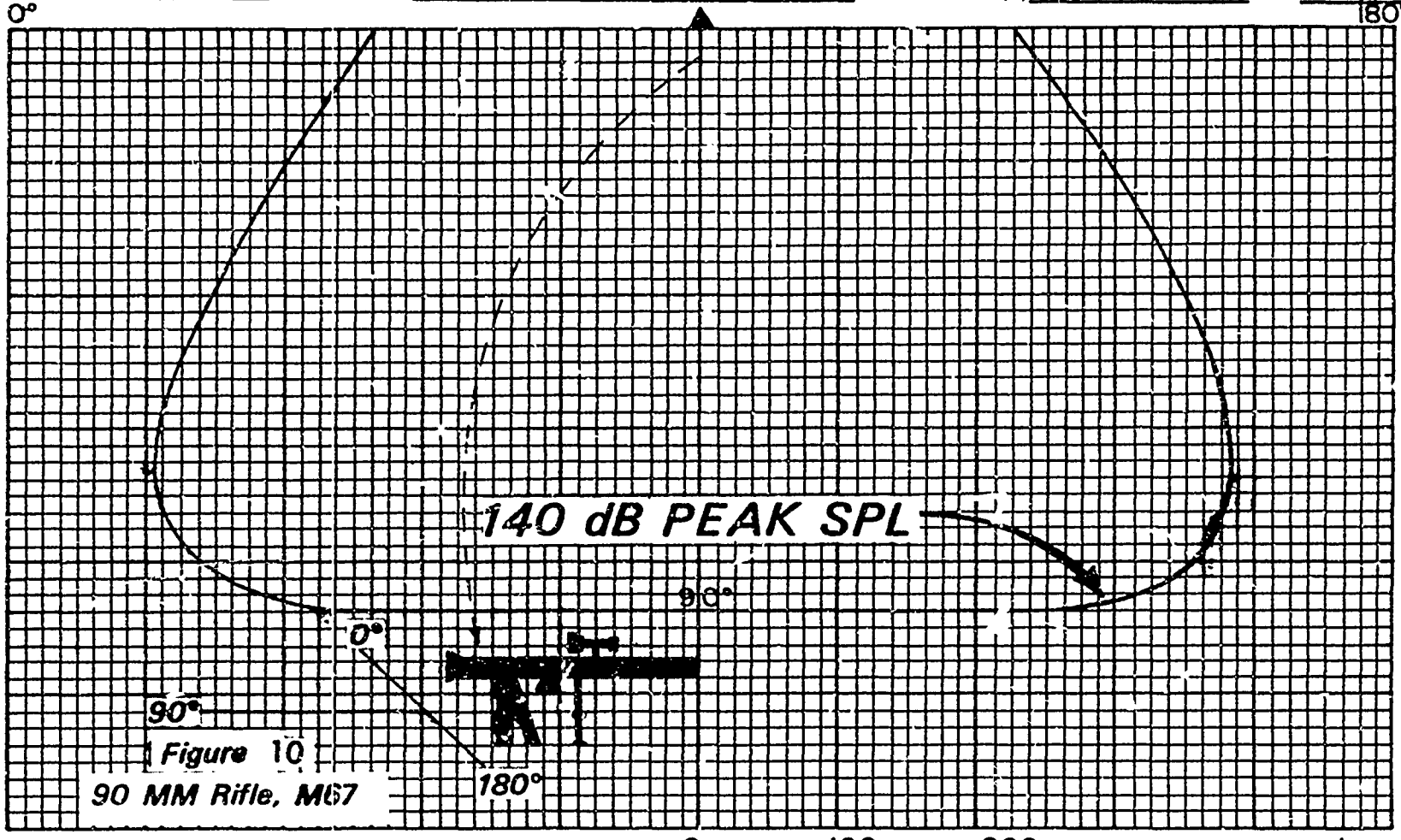

Figure 10
90 MM Rifle, M67

SCALE 1" = _____

0 100 200
SCALE IN FEET

DIRECTION

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MATERIEL CATEGORY Weapon: Individual NOMENCLATURE 66 mm Light Anti-Tank Weapon, M72 FSI.
MFG MODEL SERIAL NO. REPORT TITLE Bio-Acoustics Sp Study No. 34-007-71
REPORT NO. ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Bearce DATE Nov 1970

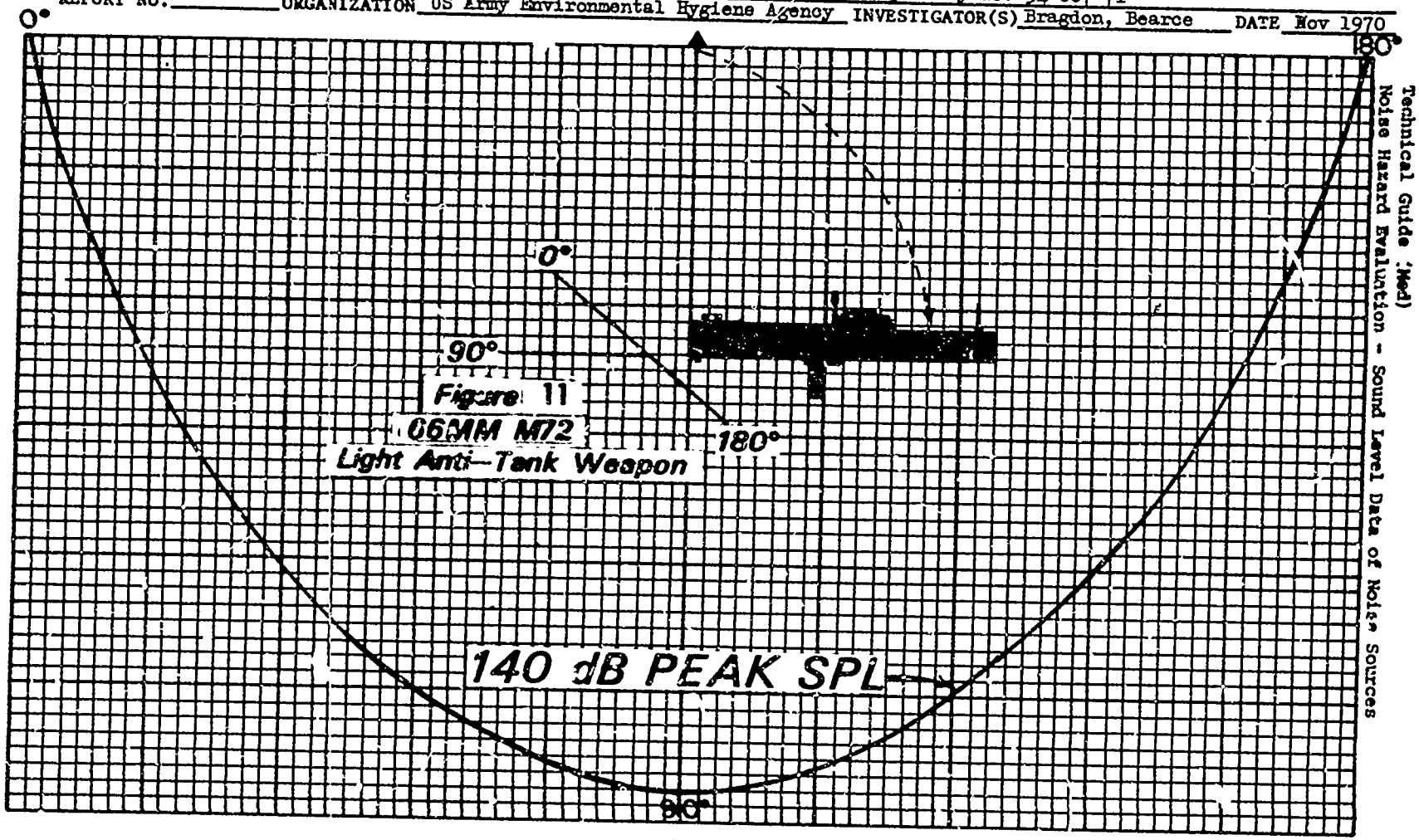


Figure 11
66MM M72
Light Anti-Tank Weapon

SCALE 1" = _____

0 60 120
SCALE IN FEET

0° 45° 90° 135° 180°
DIRECTION

USAEHA Form NP-2-2, 3 Feb 70

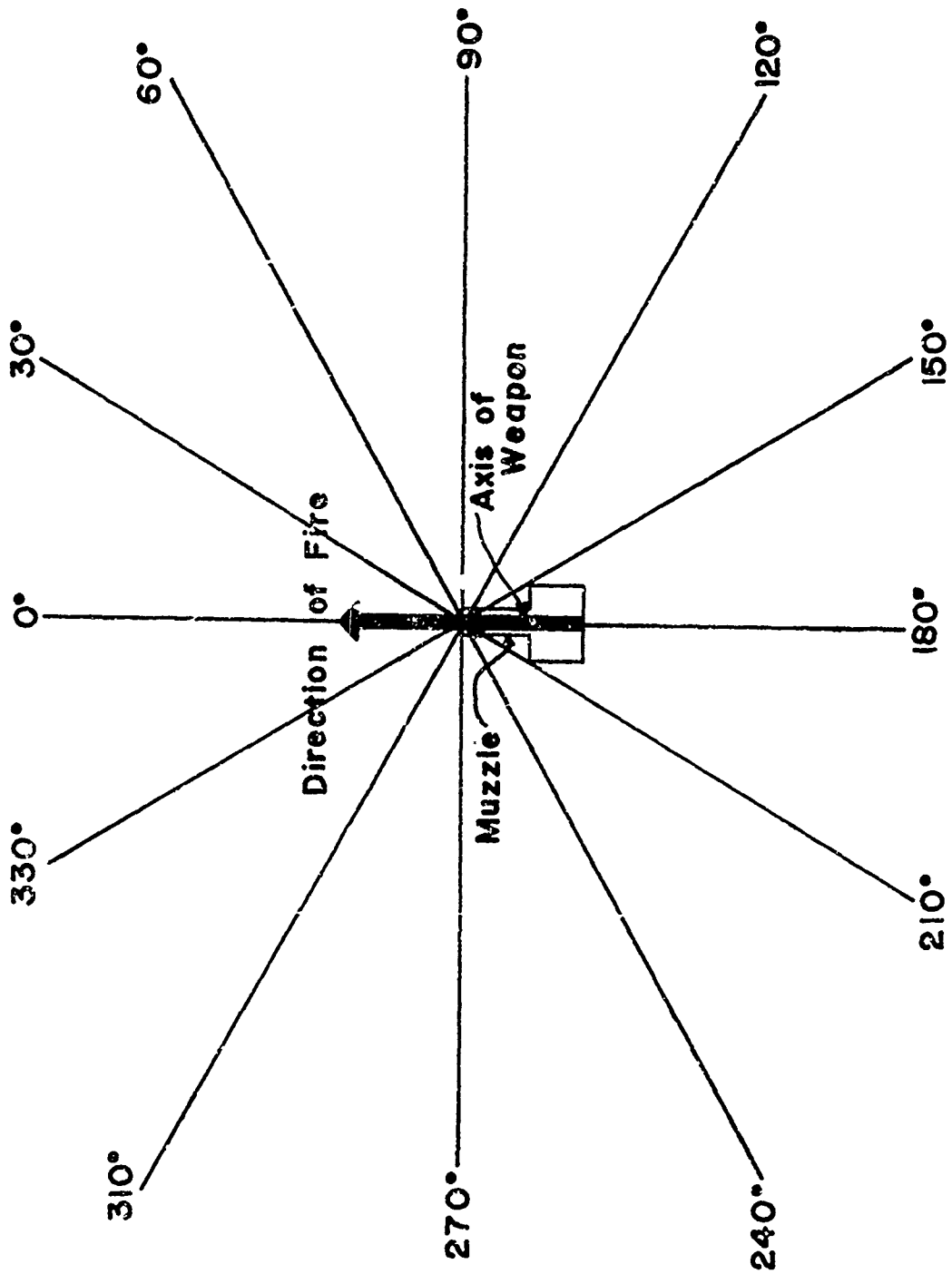


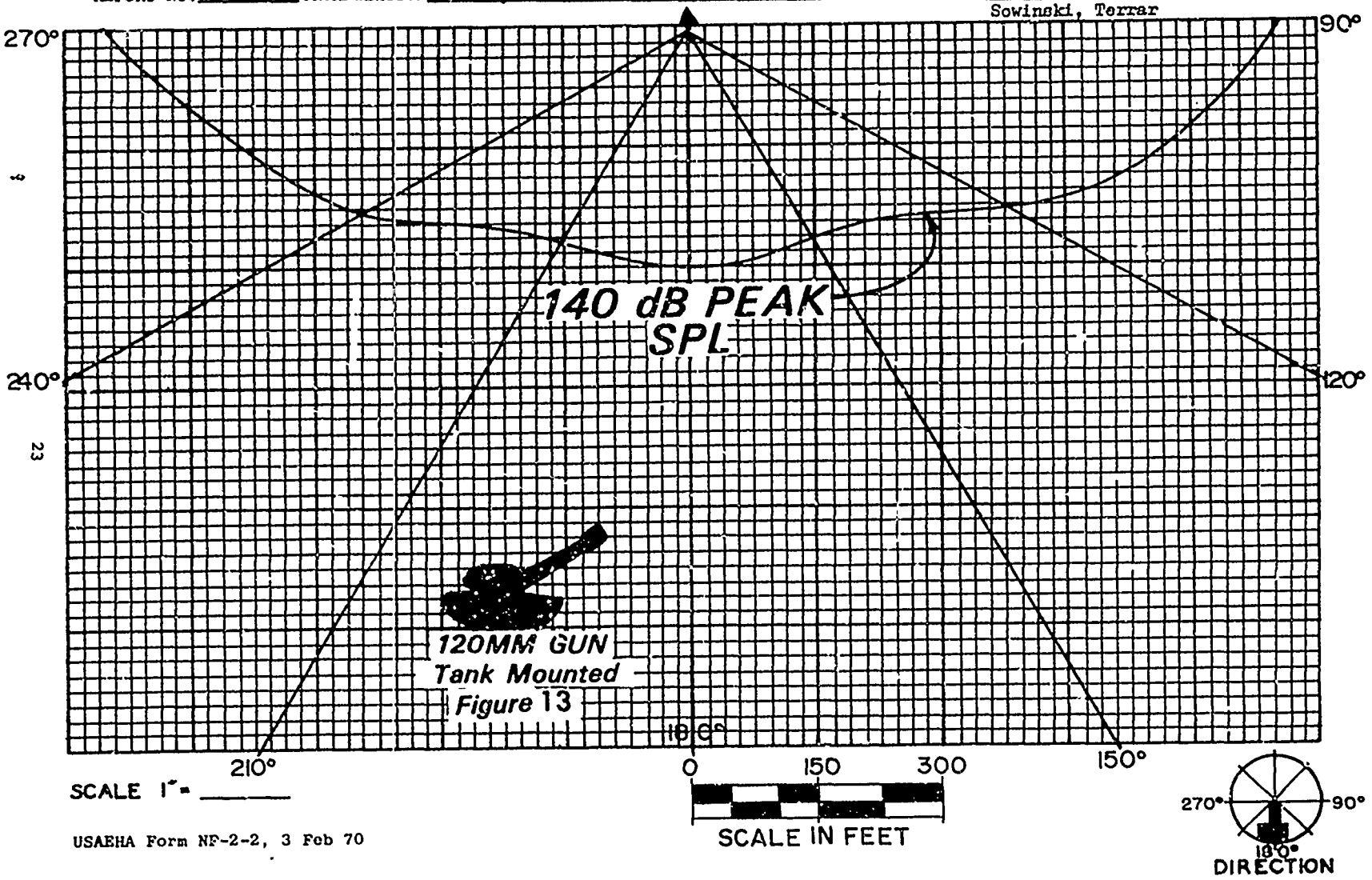
FIGURE 12 TEST SITE PLAN

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 120 mm Gun, Tank Mounted FSN _____

MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Special Study, Weapons Contour _____

REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Ryca, Sowinski, Terrar DATE 7-9 Apr 71



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NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 152 MM Gun, Pedestal Mounted FSN _____
MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Special Study, Weapons Contour
REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Ryea, Sowinski, Terrar DATE 3 June 71

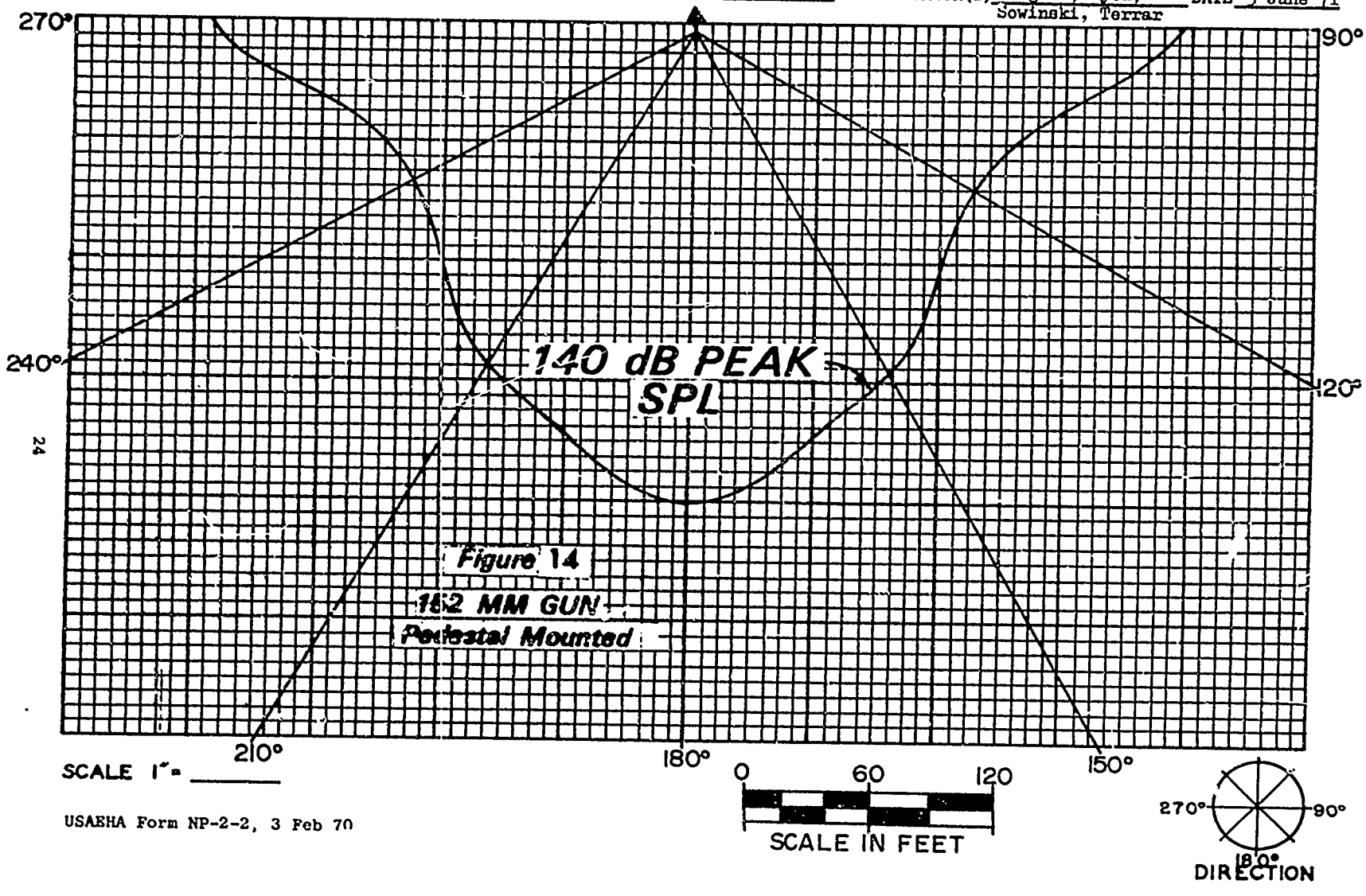

Figure 14
152 MM GUN
Pedestal Mounted

SCALE 1" = _____

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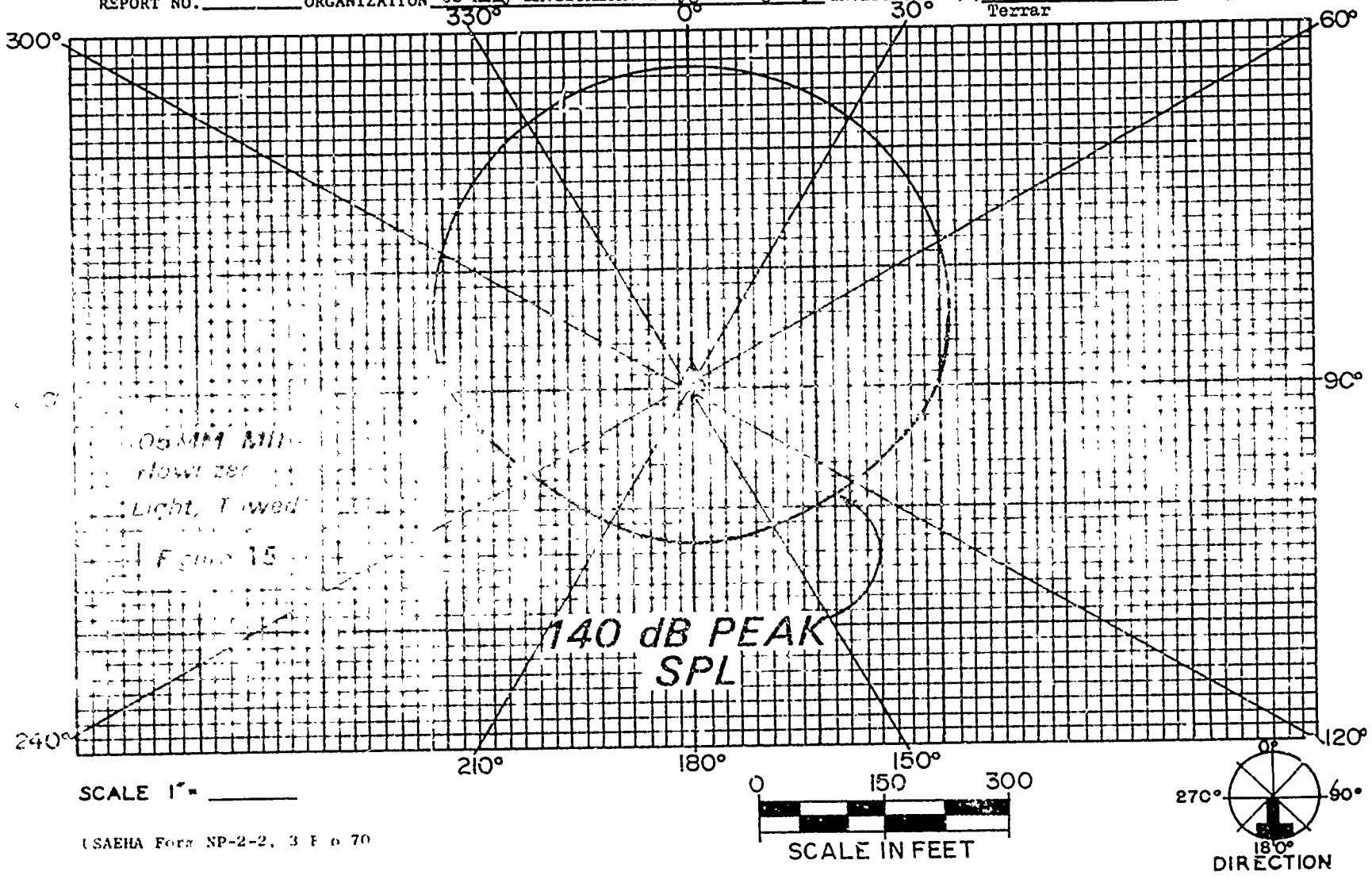
NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 105 mm Howitzer, Light, Towed, M114 FSN _____

MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study, Weapons Contour

REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Ryea, Terrar DATE 9 June 71



SCALE 1" = _____

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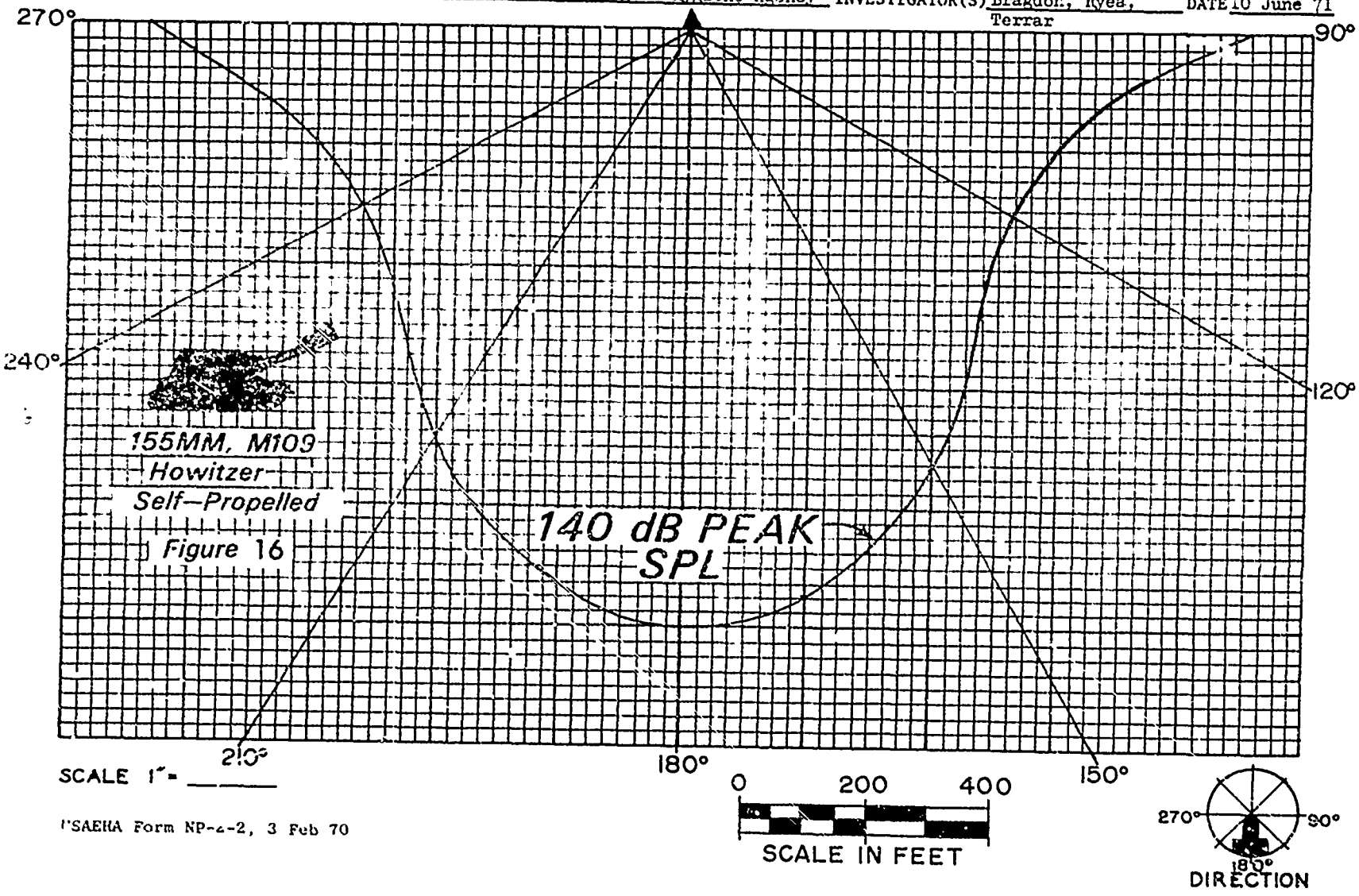
Noise Hazard Evaluation - Sound Level Data of Noise Sources

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 155 mm Self-Propelled Howitzer, M109 FSN _____
MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study, Weapons Contour
REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Ryea, DATE 10 June 71
Terrar



SCALE 1" = _____

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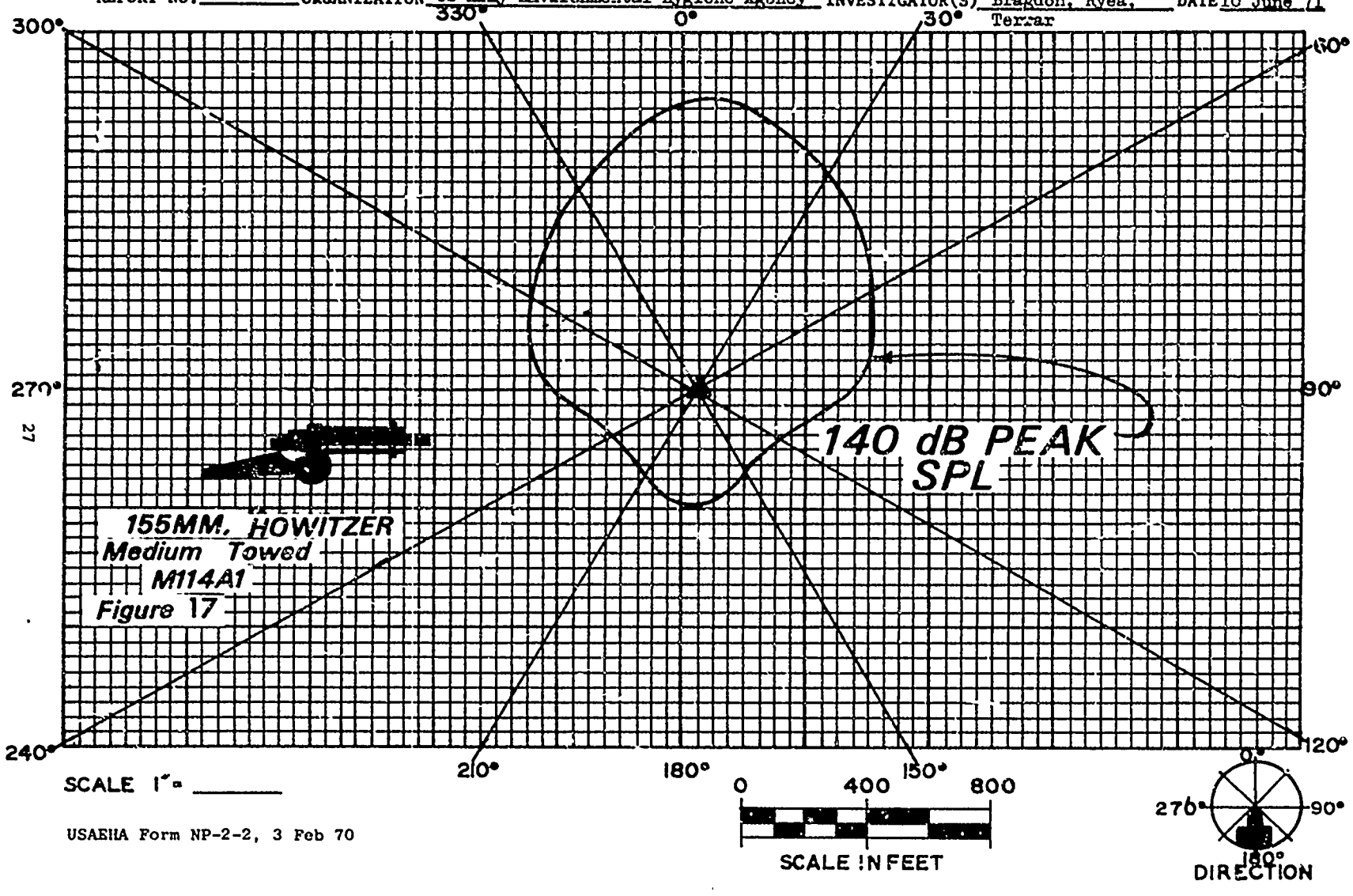
Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon: Crew Served NOMENCLATURE 155 mm Howitzer, Medium, Towed, M114A1FSN

MFG MODEL SERIAL NO. REPORT TITLE Bio-Acoustics Sc Study, Weapons Contour

REPORT NO. ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Rvea, Terrar DATE 10 June 71



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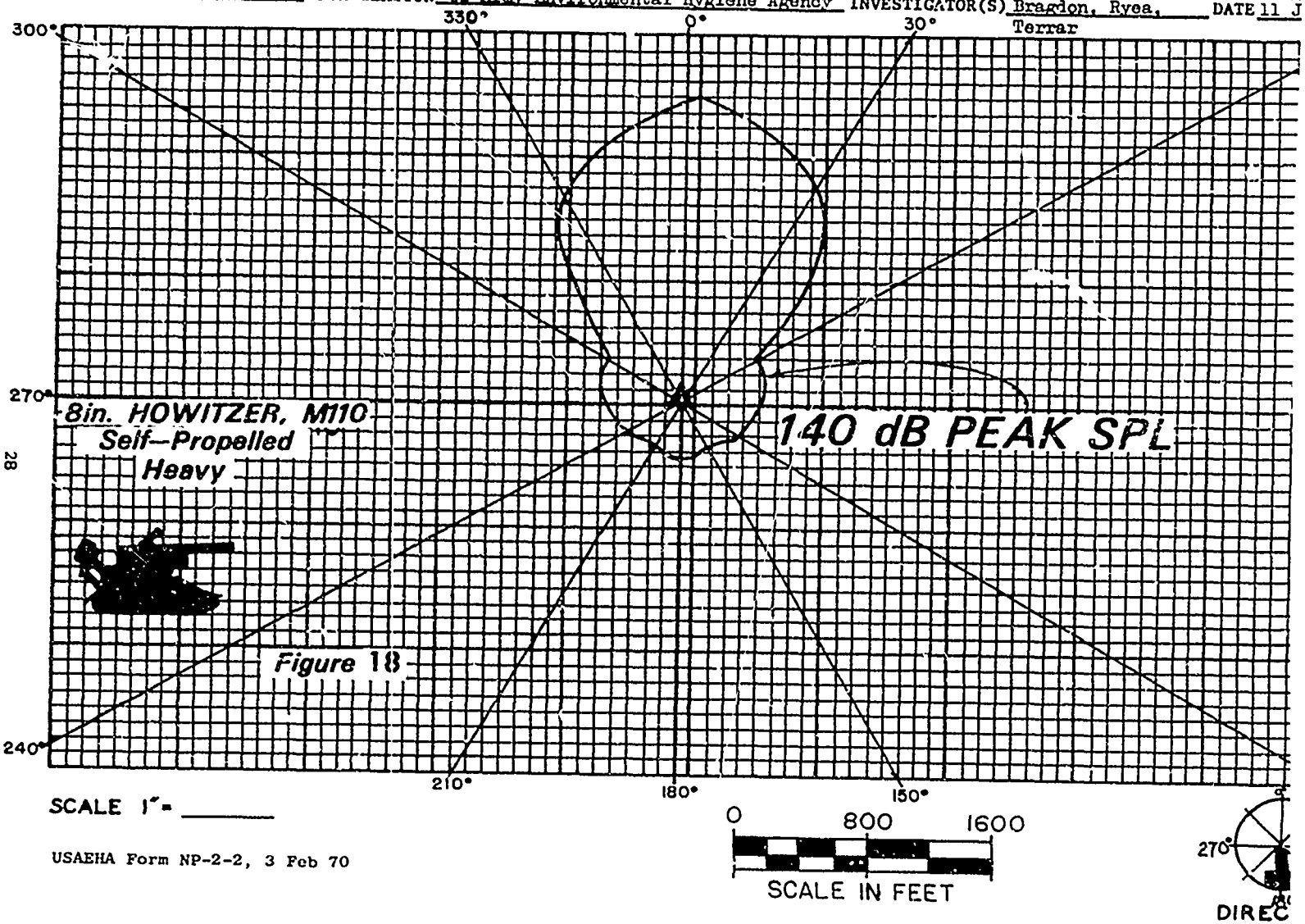
NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapons, Crew Served NOMENCLATURE 8" Howitzer, Heavy, Self-Propelled, M110
MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study, Weapons Contour
REPORT NO. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Ryea, DATE 11 J



SCALE 1" = _____

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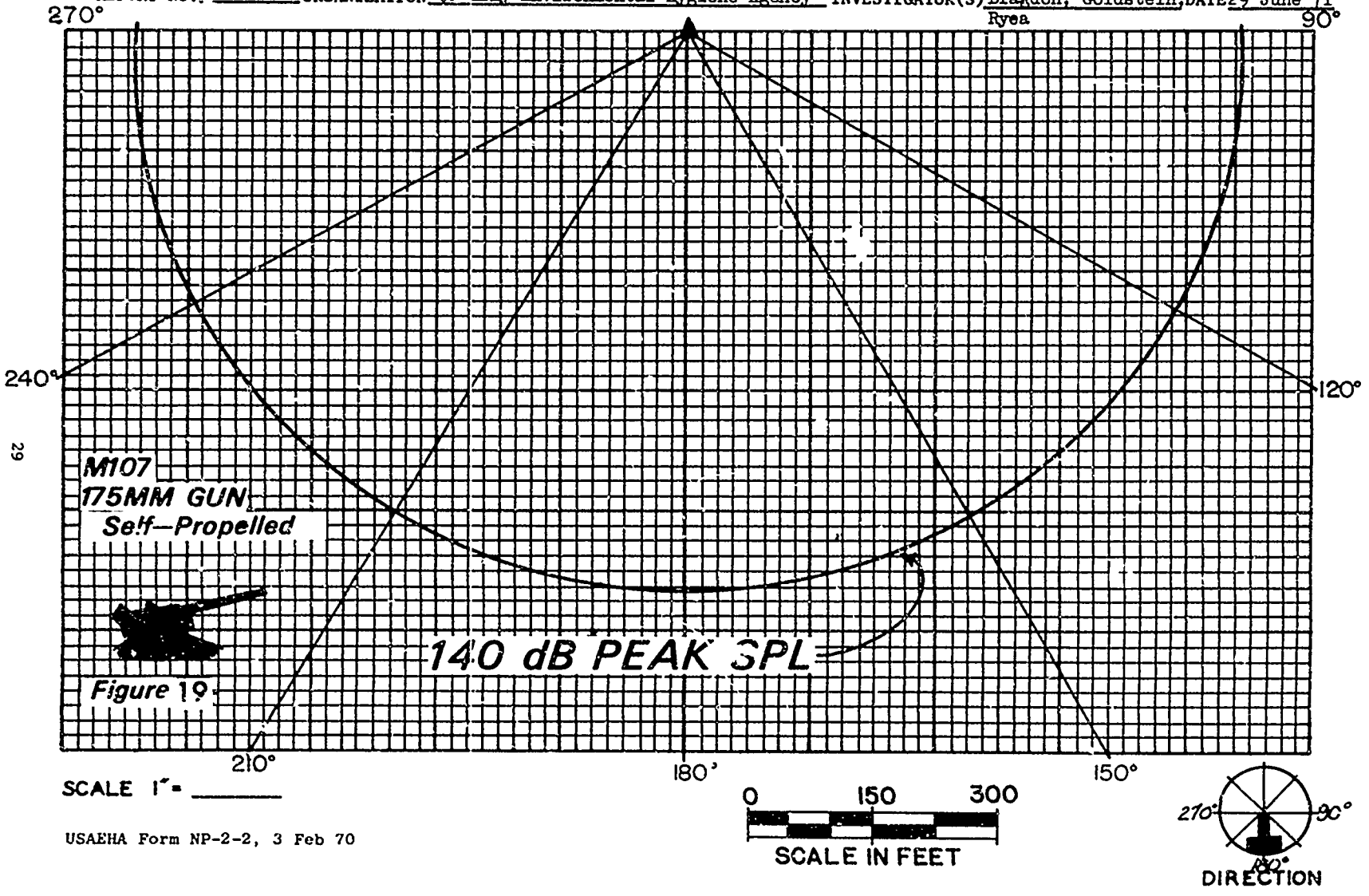
NOISE REPOSITORY CONTOUR SHEET

MATERIEL CATEGORY Weapon; Crew Served NOMENCLATURE 175 mm Gun, Self-Propelled, M107 FSN _____
MFG MODEL _____ SERIAL NO. _____ REPORT TITLE Bio-Acoustics Sp Study, Weapons Contour
REPORT NO.. _____ ORGANIZATION US Army Environmental Hygiene Agency INVESTIGATOR(S) Bragdon, Goldstein, Ryea DATE 29 June 71



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III. SOUND LEVEL DATA

A. Aircraft: Fixed Wing	Sound Level dB(A)*
1. C-5A (USAF) - (Between Pilot & Co-Pilot)	77
2. C-141A	91†
3. F-4E	107†
4. O-1E Bird Dog	108
5. OV-10A Bronco	101†
6. P-3A Navy (Co-Pilot)	90†
7. P-3A New Model 3 Navy (Co-Pilot)	90†
8. S2E	116†
9. T-41A Mescalero (Between Pilot & Co-Pilot)	96†
10. T-41C Mescalero (Between Pilot & Co-Pilot)	101
11. U-1A Otter (Co-Pilot)	110†
12. U-6A Beaver	104
13. U-8D Seminole (Between Pilot & Co-Pilot)	110†
14. U-8F Seminole (Between Pilot & Co-Pilot)	106†
15. U-9B Aero Commander (Between Pilot & Co-Pilot)	103†
16. U-21A Ute	98

*At pilot's position unless otherwise stated.
†Calculated from octave band data.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*
B.	Aircraft: Rotary Wing.	
1.	CH-21C Shawnee (Betwen Pilot & Co-Pilot)	106†
2.	CH-34C Choctaw (Between Pilot & Co-Pilot)	103†
3.	CH-37B Mojave (Between Pilot & Co-Pilot)	115†
4.	CH-47B Chinook (Between Pilot & Co-Pilot)	105†
5.	CH-47C Chinook	110
6.	HT-1A Tethered Helicopter Trainer	106
7.	OH-6A Cayuse	94
8.	OH-13 Sioux (Between Pilot & Co-Pilot)	105†
9.	OH-23 Raven	102†
10.	OH-23D Raven	107†
11.	TH-55 Helicopter	93†
12.	UH-1 Iroquois	98-110†
13.	UH-1A Iroquois (Co-Pilot)	94†
14.	UH-19D Chickasaw (Between Pilot & Co-Pilot)	86
C.	Aircraft: Short Takeoff/Landing.	
	OV-1A Mohawk (Between Pilot & Co-Pilot)	92†

*At pilot's position unless otherwise stated.
†Calculated from octave band data.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

D. Data Processing:	Sound Level dB(A)*
1. Card Processor, Univac 1004	92
2. Card Processor, Univac 1005	93
3. Card Reader, GE	92
4. Card Sorter	82
5. Disk Drive	76
6. Dura Machine, 1041	80
7. Keypunch	78
8. Keypunch, IBM 26	86
9. Printer 1401	78
10. Printer 1403	80
11. Printer 1404	80
12. Printer, GE	93
13. Verifier	75
14. Verifier, IBM 56	85

*At operator's position unless otherwise stated.

E. Machinery Fabrication: Metalworking	Sound Level dB(A)*
1. Acetylene Welding Unit, Dockson Corp. #5	92
2. Blast Cleaning Unit, Pangborn Corporation	102
3. Grinder, Aro Equipment Co. 7583C	98
4. Grinder, Aro Equipment Co. 7980	101
5. Grinder, Aro Flathead 8300P8-4	95
6. Grinder, Black & Decker	92
7. Grinder, Black & Decker, Type A	102
8. Grinder, Dayton Power 17853	95
9. Grinder, Hisey Wolf 27D	96
10. Grinder, Van Normachine Co. 444	93
11. Input Gun, Remington	104
12. Liquid Honing Machine, Vapor Blast B-20	96
13. Lock Hammer, Milwaukee Elect. Tool Corp. 4500	110
14. Metal Cutter, Tensikut 10-10, Siebury Ind.	101
15. Metal Flame Spray, METCO 4BWH	120
16. Metalizing Unit, METCO Type C	115
17. Metalizing Unit, METCO Type K	115
18. Pipe Threader, Rigid 300	93
19. Rivet Gun, Cleco E3	110
20. Sander, Metal, Black & Decker	96
21. Welding Machine, Wilson BAZOO	99

*At operator's position unless otherwise stated.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

F. Machinery Fabrication: Paper, Printing & Publishing	Sound Level dB(A)*
1. Baumfolder, Bell & Howell, 17 1/2 x 22 1/2	85
2. Baumfolder, 333, 26 x 40	91
3. Binder, Martinez, EB	92
4. Collator, Didde-Glasser, Inc.	90
5. Collator, Harris Intertype Corp. 232	82†
6. Cutler Copyflo Printer	86
7. Disintegrator, Paper, J. B. Sedbury, Size 10BC	100
8. Folding Machine, Dexter, 5R23	93
9. Folding Machine, Fold-O-Matic	88†
10. Offset P[illegible], ATF Chief 22	86
11. Offset Press, Duplicator MGD 22	86
12. Offset Press, Fairchild Davidson 500	92†
13. Offset Press, Harris, LTN 23-36	84
14. Offset Press, Multilith 1250	86
15. Offset Press, Multilith 1275	85
16. Offset Press, Multilith 2024	85
17. Offset Press, Multilith 2550	87
18. Offset Press, Multilith 2650	86
19. Paper Shredder, Model 22	96
20. Paper Shredder, S.E. Machinery Co. #3	110
21. Paper Shredder, S.E. Machinery Co. Model 1424	102

*At operator's position unless otherwise stated.
†Calculated from octave band data.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*
22.	Press, Printing	95†
23.	Printer, High Speed, Honeywell	103
24.	Pulverizer, Document	96
25.	Pulverizer, Paper	101
26.	Xerox, Copyflo Printer	77
G.	Machinery Fabrication: Stone, Clay, & Glass.	
1.	Chipping Hammer, Ingersoll-Rand, Size MC121	118
2.	Crusher, Eagle, Diesel 5157B	95
3.	Crusher, Eagle, Roll 5230B	105
4.	Crusher, Pioneer Jaw, 54VDE	109
5.	Crusher, Pioneer Secondary Roll, 154VDE	106
6.	Crusher, Eagle Roll Mfg. Co. R-6501	105
7.	Sandblasting Cabinet, Ruemelin Mfg. Co.	98
H.	Machinery Fabrication: Textile/Apparel.	
1.	Drying Tumbler, Dry Cleaning, Troy Minute Man FT11400	94
2.	Laundry Machine, Troy 60" Olympic	88
3.	Press, Pants, Colmac, Pant-O-Matic 500	90
4.	Shoe Repair	89†
5.	Stitcher, Shoe, Landis #12 Model K	96

*At operator's position unless otherwise stated.
†Calculated from octave band data.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

I. Machinery Fabrication: Woodworking	Sound Level dB(A)*
1. Bandsaw, Crob NS36	114
2. Bandsaw, Delta-Milwaukee 20	110
3. Bandsaw, Doall, Metal 26	96
4. Bandsaw, Doall, Metal 26	91
5. Bandsaw, Doall, ML 16 in	96
6. Bandsaw, Moak	100
7. Bandsaw, Tameirtz, Type G-1	94
8. Bandsaw, Zephyr 36	104
9. Chainsaw, Homelite Mfg. Co. W1Z55	115
10. Chainsaw, Homelite Super 77	125
11. Chainsaw, McCulloch MAG 10-10	108
12. Chainsaw, Whitehead Saw Co., Type II	118
13. Circular Saw, Davis & Wells, Tilting	99
14. Circular Saw, Delta Rockwell L-40-C	104
15. Circular Saw, Root Woodworking 43-20-J	102
16. Construction Saw, DeWalt Industrial 2185A	96
17. Cross-Cut Saw, Automatic 1-H	94
18. Cross-Cut Saw, DeWalt 3561-98	100
19. Cutoff Saw, DeWalt GE	107
20. Cutoff Saw, DeWalt GL	112
21. Cutoff Saw, Porter 43-20J	98

*At operator's position unless otherwise stated.

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		Sound Level dB(A)*
22.	Cutoff and Rip Combination Saw, DeWalt	112
23.	Drill, 3/8-in Skil	103
24.	Grinder, Tooline	92
25.	Jointer, General Electric	100
26.	Jointer, Oliver 166CD	87
27.	Jointer, Porter 300c	102
28.	Jointer, Powermatic 50	86
29.	Jointer, Oliver 12-80	102
30.	Mitre Saw, Rockwell Electric 34-C10	95
31.	Nailer, Duo-fast CN-137	104
32.	Panel Saw, Black & Decker T483-12	114
33.	Planer, Buss Machine Works	104
34.	Planer, Craftsman 112	98
35.	Planer, Greenell 110	102
36.	Planer, Newman 600	105
37.	Planer, Newman Surface	108
38.	Planer, Oliver 361	90
39.	Planer, Powermatic	103
40.	Planer, Powermatic 100	100
41.	Planer, Powermatic 224	99
42.	Planer, Rockwell Motor	100
43.	Planer, Woodworkers	112

*At operator's position unless otherwise stated.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

	Sound Level dB(A)*
44. Planer, Yates J18	104
45. Power Saw, Delta	94
46. Power Saw, Delta Unisaw CM505	94
47. Power Saw, Newman-Surfacer	100
48. Radial Saw, 450	106
49. Radial Saw, Delta Rockwell	96
50. Radial Saw, DeWalt	108
51. Radial Saw, DeWalt CA509	102
52. Radial Saw, DeWalt C-E-57	104
53. Rip Saw, Atlas 3090	97
54. Rip Saw, Delta Rockwell	100
55. Rip Saw, G.B. Diekl	96
56. Rip Saw, G.B. Diekl 750	99
57. Rip Saw, GM Diehr 750	92
53. Rip Saw, Wabach Industrial 750	97
59. Rip Saw, Yates American B.	102
60. Router, Black & Decker	118
61. Router, Rockwell 150B	100
62. Saber Saw, Milwaukee	93
63. Sander, Black & Decker	92
64. Sander, Reliance, Type GS	90

*At operator's position unless otherwise stated.

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		Sound Level dB(A)*
65.	Shaper, Delta Rockwell	94
66.	Shaper, Master, Type PA	104
67.	Surfacer, Newman	100
68.	Swing Saw, Oliver 136	90
69.	Table Saw, Atlas 3160	89
70.	Table Saw; Beach	108
71.	Table Saw; Delta 100	90
72.	Table Saw, Northfield	105
73.	Table Saw, Oliver 290	104
74.	Table Saw, Tannewitz, Type J	107
75.	Table Top Saw, Northfield Arror	105
J.	Machinery Fabrication: Pneumatic.	
1.	Bander, Air, Gerrad & Cc. 689	99
2.	Chisel, Air, Chicago Mfg. Co. 1104	125
3.	Drifter, Pneumatic, Ingersoll-Rand, CM150AD475A	116
4.	Drill, Air, Aro 7512D	92
5.	Drill, Rock, G900	118
6.	Hammer, Pneumatic	97†
7.	Hammer, Skil 1160-T1	132
8.	Motor, Air DOTCO 10-252A	94

*At operator's position unless otherwise stated.
†Calculated from octave band data.

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		Sound Level dB(A)*	Peak
9.	Nailer, Bostich N2		142
10.	Nailer, FAS		141
11.	Rivet Gun, B.F. Goodrich	101*	
12.	Riveter, Chicago, Aero #2	92*	
13.	Sander, Disk, National-Detroit Dual Action	100	
14.	Stapler, Senco M11	94*	
15.	Stapling Gun, Bostich II	105*	
16.	Stapling Gun, Bostich III	104*	
17.	Wrench, Air Speed, Cleco WP600	107	
18.	Wrench, Sioux Corp. '16	95	
K.	Machinery Fabrication: General.		
1.	Chamber, Environmental Test, Thermatron Corp., Model F-62-CHU-25-25	92	
2.	Conveyor, Link Belt Co.	104	
3.	Disintegrator, Hines 1425	92	
4.	Elevator, Aggregate, Barber-Green 882-241	105	
5.	Extractor, Money, American Laundry Machine Company	104	
6.	Footworking Machine, 43-20J	100	
7.	Hose, Airline, DeVilbiss, DGB	100	
8.	Nibbler, Modern Mfg. Co.	97	

*At operator's position unless otherwise stated.

		Sound Level dB(A)*
9.	Pumps, Water, Fairbanks-Morse Type H	98
10.	Spectrometer, Metal, SpecPower, National Spec. Laboratory	92
11.	Streak, Camera, Beckman & Whitey, Model 70	98
12.	Surgical Equipment Cleaner, 1224LR	94
13.	Tanks, Impregnating. 1-36-54J	120
L.	Vehicles: Noncombat.	
1.	Case 310 (Noise Abatement)†	97
2.	Caterpillar, 824	109
	(Noise Abatement)†	91
3.	Caterpillar, 922 (Noise Abatement)	85
4.	Caterpillar, 922B	95
	(Noise Abatement)†	89
5.	Caterpillar, 933 (Noise Abatement)†	89
6.	Caterpillar, 950 (Noise Abatement)†	87
7.	Caterpillar, 955H (Noise Abatement)†	93
8.	Caterpillar, 966B	96
9.	Caterpillar, 977H	101
	(Noise Abatement)†	86
10.	Caterpillar 988	96

*At operator's position unless otherwise stated.
†Not specified in report.

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		Sound Level dB(A)*
11.	Caterpillar, D4 (Noise Abatement)†	92
12.	Caterpillar, D7	100
	(Noise Abatement)†	90
13.	Caterpillar, D8	103
14.	Caterpillar, D9	89
15.	Caterpillar, Land Clearing Kit, 97F	104
16.	Crane, Bucyrus Erie, 22BM	99
17.	Crane, Bucyrus Erie, Crawler Shovel	101
18.	Crane, Drag Line, LS-68	101
19.	Crane, Hanson, H446A, 5 ton	91
20.	Crane, Koehring Company, 3/4 yard	103
21.	Crane, Pauling & Harnischе	102
22.	Crane, Rough Terrain, 20 ton	101
23.	Crane, Rough Terrain, American Hoist and Derrick Company	104
24.	Crane, 220 HP Diesel Engine, 100 ton	95
25.	Ditcher, Parsons 624VL	104
26.	Ditcher, Pow-R, Vermeer Co.	99
27.	Drill, Rock, Gardiner Denver	112
28.	Drill, Rock, Ingersoll-Rand	116

*At operator's position unless otherwise stated.
†Not specified in report.

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		Sound Level dB(A)*
29.	Euchal, 72-21 (Noise Abatement)†	96
30.	Euchal, 82-30 (Noise Abatement)†	89
31.	Euchal C-6	102
	(Noise Abatement)†	92
32.	Euchal R35 (Noise Abatement)†	89
33.	Euchal TS-24	101
	(Noise Abatement)†	91
34.	Evinrude Skeeter, Snowmobile	87
35.	Fork Lift, 6K, AC, WH	95
36.	Fork Lift, 10K	100
37.	Fork Lift, Athey, 6K, RT, DES	97
38.	Fork Lift, Baker, 6K, WH	95
39.	Grade-All, G800 (Noise Abatement)†	86
40.	Grade-All, Warner & Swasey G600	96
41.	Grader, Caterpillar 12	108
42.	Grader, Caterpillar 120	99
43.	Grader, Galion Co., three cylinder	98
44.	Grader, WABCO 330	106
45.	Grove 35	92
	(Noise Abatement)†	88
46.	Grove RT48 (Noise Abatement)†	90

*At operator's position unless otherwise stated.
†Not specified in report.

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		Sound Level dB(A)*
47.	Hough, H70	93
48.	Hough, H100	98
49.	Hough, H120	100
50.	Hough H400	95
	(Noise Abatement)†	84
51.	Hough, HA (Noise Abatement)†	91
52.	Hough, Hog	98
	(Noise Abatement)†	91
53.	Hough, HM	91
54.	Hough, TD 300 SL	100
	(Noise Abatement)†	98
55.	International, INT TD 30	103
56.	International TD-9 (Noise Abatement)†	95
57.	International Travelall D-1000	71
58.	Kaiser Jeep Wagoner	78
59.	Kenworth, W923	93
60.	Liquid Distributor, Universal	91
61.	Loader, AC, 645M	98
62.	Loader, Euclid, 128 HP	100
63.	Loader, Hough, H90 CM	104
64.	Loader, Lance Transport	81‡
65.	Lorain ML-250	98
	(Noise Abatement)†	86

*At operator's position unless otherwise stated.
†Not specified in report.
‡Calculated from octave band data.

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		Sound Level dB(A)*
66.	Lull 7C1-31	92
67.	Mack F685ST	91
68.	Moto-Ski, 399, Snowmobile	92
69.	Moto-Ski, 500, Snowmobile	87
70.	Moto-Ski, Zephyr, Snowmobile	87
71.	Oliver 46-3 (Noise Abatement)†	91
72.	Oliver OC4 (Noise Abatement)†	92
73.	Pettibone, 15 (Noise Abatement)	104 94
74.	Polaris Mustang, Snowmobile	84
75.	Polaris TX, Snowmobile	91
76.	Raider 400, Snowmobile	77
77.	Recovery Vehicle, A-Wing M88	94
78.	Roller, Roll-O-Packer	111
79.	Ski-Doo 300, Snowmobile	90
80.	Ski-Doo Alpine 399 ER, Snowmobile	80
81.	Ski-Doo Elan, Snowmobile	80
82.	Ski-Doo Nordic 375, Snowmobile	86
83.	Ski-Doo Olympique, Snowmobile	90
84.	Ski-Doo TNT, Snowmobile	92
85.	Ski-Whiz, Snowmobile	86

*At operator's position unless otherwise stated.
†Not specified in report.

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		Sound Level dB(A)*
86.	Sno-Jet, Snowmobile	99
87.	Sweeper, Elgin Sweeper Company 475	97
88.	Sweeper, Street, Wayne Mfg. Co. 973	88
89.	Tractor, Caterpillar D5A	101†
90.	Tractor, Caterpillar D7E	106
91.	Tractor, Caterpillar 830MB	102
92.	Tractor, Diesel 290M	81†
93.	Tractor, Ford, Selecto-Speed 881	96
94.	Tractor, International Harvester, I2504	87
95.	Tractor, International Harvester, I2656	90
96.	Tractor, International Harvester, Diesel TD-15	95
97.	Train, Diesel Electric, 120 Ton, B-2074	78
98.	Truck, Cargo M656	102
99.	Truck, Euchal (Noise Abatement)‡	101 85
100.	Truck, Ford P-500	84
101.	Truck, Fork Lift, Anthony Company	102
102.	Truck, International F2000 DYT	95
103.	Truck, Kenworth, W923	92
104.	Truck, Mack F-785T	91
105.	XM759	108

*At operator's position unless otherwise stated.
†Not specified in report.
‡Calculated from octave band data.

Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*
M.	Vehicles: Combat.	
1.	Car, Armored, Light, XM706 Commando 4X4, Cruising Speed 35 MPH	103
2.	Carrier, Armored Personnel, M113A1, FMC Corporation. Troop Compartment during operation - 30 MPH	117
3.	M48 Tank Engine (maintenance area)	93
4.	M106A1, Carrier, Mortar - 30 MPH	116
5.	M110 Chasis for self-propelled gun motor carriage, Idle speed - 1500 RPM	103
6.	M113, Carrier, Full-tracked - 30 MPH	119
7.	M114A1, Carrier, Retrofitted, Command and Reconnaissance	109
8.	M548, Carrier, Cargo, Full-tracked - 35 MPH	114
9.	Tank Engine, AVS1 895 Operating at Idle Speed	96
10.	Tank, Sheridan, M551 Diesel, Idle Speed during General Maintenance	106
11.	XM577, Carrier, Command Post - 30 MPH	120
12.	XM727, Carrier, Missile - 2500 RPM	104
13.	XM765, Combat Vehicle, Mechanized Infantry - 30 MPH	110

*At operator's position unless otherwise stated.

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Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*	Peak
N.	Vehicles: General.		
1.	Engine, 113-A1, 6V-53	96	
2.	Engine, AV 51 895	96	
3.	Engine, Continental Corp. M60	104	
4.	Engine, Diesel, Caterpillar D-346	101	
5.	Engine, Diesel, Detroit 6V53	111	
6.	Engine, Diesel, Detroit AV71T	118	
7.	Engine, Diesel, Eagle Crusher 5157B	95	
8.	Engine, Diesel, Eagle Roll Crusher 5230B	105	
9.	Engine, Diesel, General Motors V16	98	
10.	Engine, M48-A2	100	
11.	Pump, Fuel Injector, Tester, Bosch Pump	107	
12.	Whistle, Locomotive, GE 39360	119	
O.	Weapons: Artillery.		
1.	Cannon, 20 mm Vulcan XM163		163
2.	Howitzer, 105 mm (gunner position)		189
3.	Gun, 175 mm (commander position)		166
4.	Gun, Air Defense, Artillery, 20 mm (gunner position)		150
5.	Gun, Command Track, 20 mm, M-114		150

*At operator's position unless otherwise stated.

Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*	Peak
6.	Gun, Tank, 105 mm (measured 13 ft away)		179
7.	Gun, Tank, 152 mm, XM625 (left gunner outside position)		189
8.	Gun, Tank, 152 mm, XM657E1 (assistant driver's position)		191
9.	Gun, Tank, M48A2, 90 mm (measured 12 ft away)		187
10.	Gun, Tank, M48A3, 90 mm		181
11.	Gun, M68, Tank-mounted, 105 mm (measured 13 ft away)		179
12.	Howitzer, 155mm Medium, M1A2E3		185
13.	Launcher, Grenade, 40 mm, XM182		166
P.	Weapons: Individual Small Arms.		
1.	Grenade, Hand, M-26 (25 ft away)		171
2.	Grenade, Hand, M-116A1 (75 ft away)		142
3.	Infantry Assault Weapon, Light, LAW M-72, M72A1		180
4.	Launcher, M20-A, 35" Rocket		171
5.	Rifle, M14, 7.62 mm, Automatic		159
6.	Rifle, M16, 5.56 mm, Automatic		156
Q.	Weapons: Crew Served Small Arms.		
1.	Gun, Vulcan, 20 mm, M61A1		153
2.	Gun, Vulcan, 20 mm, XM197		159
3.	Machine Gun, 50 caliber		160

*At operator's position unless otherwise stated.

Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)* Peak
4.	Machine Gun, M60, 7.62 mm	155
5.	Minigun, 7.62 mm	146
6.	Minigun, 20 mm	155
7.	Mortar, 81 mm	161
8.	Rifle, Recoilless, M18, 57 mm	174
9.	Rifle, Recoilless, M40A1, 106 mm	188
10.	Rifle, Recoilless, M67, 90 mm	181
11.	Submachine Gun, XM177E2, 5.56 mm	160
R.	Weapons: Armament Subsystems.	
1.	7.62 mm, M73E1, Machine Gun	145
2.	Gun, 20 mm, M139 mounted on M113 Carrier, Personnel, Full Tracked, Armored	147
3.	20 mm, M139 Weapon installed on XM808 Twister Vehicle	152
4.	Claymorette Mine on M113 Personnel Carrier	148
5.	Two Machine Guns, 7.62 mm, M73, mounted on Cupola XM33 SM734 Full Tracked, Armored Personnel Carrier	142
6.	XM-8, 40 mm Grenade Launcher, mounted on OH-6, Cayusé	163
7.	XM-27, 762mm Machine gun, mounted on OH-6A Cayuse	154
8.	XM-30, 30 mm Automatic gun, mounted on UH-1C, Iroquois	157

*At operator's position unless otherwise stated.

Technical Guide (Med)
Noise Hazard Evaluation - Sound Level Data of Noise Sources

		Sound Level dB(A)*	Peak
9.	XM-41, 7.62 mm Machine gun, mounted on CH-47A, Chinook		148
10.	XM-59, 50 Caliber Machine gun mounted on UH-1, Iroquois		169
11.	XM-129, Grenade Launcher, mounted on AH-1G, Huey Cobra†		162
12.	XM-134, Machine gun, mounted on AH-1G, Huey Cobra		132
S.	Weapons: Missile Systems.		
1.	Atlas	128	
2.	Bomarc	112	
3.	Chaparral		146
4.	Dragon		184
5.	Jupiter	118	
6.	Matador	110	
7.	Pershing	112	
8.	Thor	115	
9.	Titan	128	
10.	T.O.W.		170
11.	Vanguard	116	

*At operator's position unless otherwise stated.
†External Measurement.

IV. HEARING PROTECTIVE DEVICES.

A. Three types of hearing protective devices are presently in the Army's inventory: the insert type (preformed and formable earplugs); the circumaural type, or ear muff; and the helmet, which incorporates communication components with a protective shell. Ordinarily, if an electronic communication system is not involved, earplugs and ear muffs are used, either alone or in combination. Only the earplugs listed in paragraph IV.B. have been approved by The Surgeon General of the Army. They have been tested for attenuation characteristics, durability, and freedom from possible toxic effects. In addition, only approved helmets and ear muffs that have been tested in accordance with military standards and specifications are authorized for use.

B. Helmets and ear muffs (aural protector, sound) are listed by National Stock Number in Supply Bulletin 700-20, Army Adopted and Other Items of Material for Authorization, 1 September 1973, page 2-14. Similar information for earplugs is contained in Federal Supply Catalog C-6515-IL. All of the hearing protective devices listed in these two documents [except the obsolete combat vehicle crewman's helmet (T56-6)], when properly used, provide attenuation equal to state-of-the-art capabilities. Selection, therefore, is based upon uniform, equipment, and situations requiring helmet-type headgear or radio-wire communication systems. Single flange earplugs, however, are suitable for use with helmets (such as the T56-6) and communication headsets if sufficient volume is available in the communication system. The combat vehicle crewman's helmet (T56-6) is being replaced by a new tanker's helmet, Model DH-132 that will provide adequate attenuation. Earplugs need not be used in combination with ear muffs unless the exposure exceeds 115 dB(A) steady-state noise. Preformed earplugs must be fitted individually to each ear by medical personnel to obtain adequate noise attenuation and maximum comfort. Suggested initial procurement percentages for the V-51R earplugs are as follows: extra-small, 5 percent; small, 15 percent; medium, 30 percent; large, 30 percent; and extra-large, 15 percent. Approximately 5 percent of the ear canals will be too large for the extra-large single flange plug. In these cases, the large triple flange plug should be tried. Failing this, arrangements should be made at an ear, nose, and throat clinic to obtain a custom molded device. Initial procurement of the triple flange variety should be 5 percent small, 75 percent regular, and 20 percent large. The triple flange earplugs are recommended when fittings are to be done in a limited period of time, such as at reception centers, for less time is required to fit the triple flange plug. Since ear canals vary widely in sizes and shape, it is necessary to have all sizes of both types of plugs (the single and triple flange) available for fitting and issue.

C. Damage to hearing is frequently incurred on the firing range where individuals are exposed to high noise levels and fail to utilize the hearing protectors which have been provided. Protection of permanent party personnel

is particularly important since they are subjected to long periods of daily exposure. The requirement for special headgear, e.g., helmets and helmet liners, precludes the use of standard circumaural protectors (ear muffs). Type II ear muffs designed with a suspension that can be worn over the head, behind the head, or under the chin can be used by permanent party personnel wearing drill instructor hats.

D. In view of the above information, it is recommended that earplugs be used by trainees, and ear muffs be used by permanent party personnel during weapons firing in a training situation. Each installation should determine the most feasible protective device for use by visitors.

V. SOUND MEASUREMENTS.

A. References. These data represent the best available information derived from various sources including surveys conducted by this Agency, and evaluation data provided by the following agencies:

1. USA Aeromedical Research Laboratory, Ft Rucker, Alabama.

2. Human Engineering Laboratories, Aberdeen Proving Ground, Maryland.

3. Ballistic Research Laboratories, Aberdeen Proving Ground, Maryland.

4. USA Medical Research Laboratory, Ft Knox, Kentucky.

5. USA Research and Development Laboratories, Ft Belvoir, Virginia.

6. Engineering and Environmental Test Section, Test & Evaluation Command, Aberdeen Proving Ground, Maryland.

7. USA Electronics Command, Ft Monmouth, New Jersey.

8. USAF, School of Aerospace Medicine, Brooks Air Force Base, Texas.

B. Measurements. All sound level data presented for impulse noise sources (i.e., weapons fire) are measured in decibels peak sound pressure level. The sound level data for steady-state noise sources are presented in decibels using the A-weighting network [dB(A)]. Unless otherwise specified, all sound level measurements were taken at the operator's position, with the materiel operating at its maximum sound output. In some instances, a maximum measured sound level is presented independent of the test conditions or site locations. The sound levels presented in this Guide are considered typical for each noise source.

C. Weapon Characteristics. Information concerning the test data, locations, and ammunition of the artillery weapons is contained in the Appendix.

APPENDIX

WEAPON CHARACTERISTICS

WEAPON	TEST DATE	LOCATION		AMMUNITION				
		Installation	Range	No. of Rounds	Type	Propellant Composition	Propellant Charge Designation No.	Propellant Charge
120 mm Gun, Tank Mounted	7-9 Apr 71	Camp Lejeune North Carolina	G-7	66	High Explosive (HE)	M58 M58	M45 M99	1 Charge (12.6 lbs charge weight) (22.3 lbs)
152 mm Gun, Pedestal Mounted, M81E1	3 Jun 71	Aberdeen Proving Ground, Maryland	H Field	32	do	M26E1	XM190	1 Charge (92.4 oz charge weight)
105 mm Howitzer, Light, Towed, M101A1	9 Jun 71	Fort Sill, Oklahoma	Firing Points 416 East 498 East	35	do	M1	M67	Zone 4 (16.3 oz charge weight)
155 mm Howitzer, Medium, Towed, M114A1	10 Jun 71	do	Firing Points 90 North 90 South	24	do	M1	M3	Zone 3 (49.4 oz charge weight) Zone 4 (63.7 oz charge weight)
8 inch Howitzer, Heavy, Self-Propelled, M110	10 Jun 71	do	Firing Point 90 North	31	do	M1	M3	Zone 5 (209.1 oz charge weight)
155 mm Howitzer, Medium, Self-Propelled, M109	11 Jun 71	do	Firing Point 90 North	19	do	M1	M3	Zone 3 (49.4 oz charge weight) Zone 4 (63.7 oz charge weight)
175 mm Gun, Field Artillery, Self-propelled, M107	29 Jun 71	Aberdeen Proving Ground, Maryland	Position #3	28	do	M6	M86A2	Zone 3 (57.2 lbs charge weight)